



Final draft

City of Johannesburg's Water Security Strategy

January 2022



a world class African city



Acknowledgements

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1 Introduction

Water is essential to human livelihoods and is intrinsically interconnected to all other aspects of life such as agriculture and food preparation, energy, health and wellbeing and ecological systems. The nature of these interconnections makes water security a top priority in many global and local agendas. For example, the World Economic Forum ranked water crisis in the top ten global risks of 2020 in relation to impact and likelihood (1) and it has been listed in the top five global risks in terms of impact since 2015. And ensuring the availability and sustainable management of water and sanitation for all by 2030 is the 6th Sustainable Development Goal of United Nations General Assembly, although globally the world is not on track to achieving this target (2).

Acknowledging the essential need for water, and thus water security, for the functioning and survival of cities and their citizens, the City of Johannesburg (CoJ) aims to become a water secure city by 2040. A water secure city is a city that has achieved its water security, which is defined by UN Water as (3):

“The capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.”

To achieve water security, CoJ needs to holistically and sustainably manage its urban water system. An urban water system, see **Figure 1**, is the interconnected system that comprises the physical water cycle flows and the supporting water governance structures. The physical water cycle flows include the water supply and sanitation services flows, wastewater treatment and reuse flows, stormwater management, treatment and reuse flows, alternative water source flows and discharges flows. The supporting water governance structures include multi-level governance, financing, data and knowledge management, and shared values and visions.

Johannesburg should have a grasp on its current and future threats and risks to ensure the municipality's approach is holistic. One of the major risks is climate change, to which remedial actions need to be urgent and purposeful. Hereinto, South Africa is considered a water scarce country; its average annual precipitation is 450mm per year (4) compared to the global annual average of 786mm per year (5). In addition, future climate scenarios for South Africa project the climate being warmer and drier (6), thus the importance of effective water management is both

urgent and critical to the sustainability and longevity of the country, with Johannesburg being the main economic hub thereof.

Moreover, a growing population at national and local levels is likely to have a substantial impact on water security. At the national level, South Africa's population has already increased by 15.8% from 2010 to 2020 to ~59.3 million people (7), of which 67.4% live in urban centres (7). Additionally, the national population is projected to increase to ~80 million by 2050, under a high growth rate scenario (8), with the majority of that growth expected to take place in the urban centres (8,9).

The City of Johannesburg (CoJ) Municipality's population was estimated at ~5.74 million people in 2020 (10). The municipality is the largest urban area in South Africa. Its population is projected, under the high growth scenario, to increase by 45% by 2050 to ~8.1 million people (11). A growing population causes the local water demand to increase and can negatively impact the quality of the urban water, due to an increase in the urban pollution. Both factors add more pressure to the already stretched surface water source supplies and the aging water infrastructure while further degrading the urban water thereby limiting potential reuse.

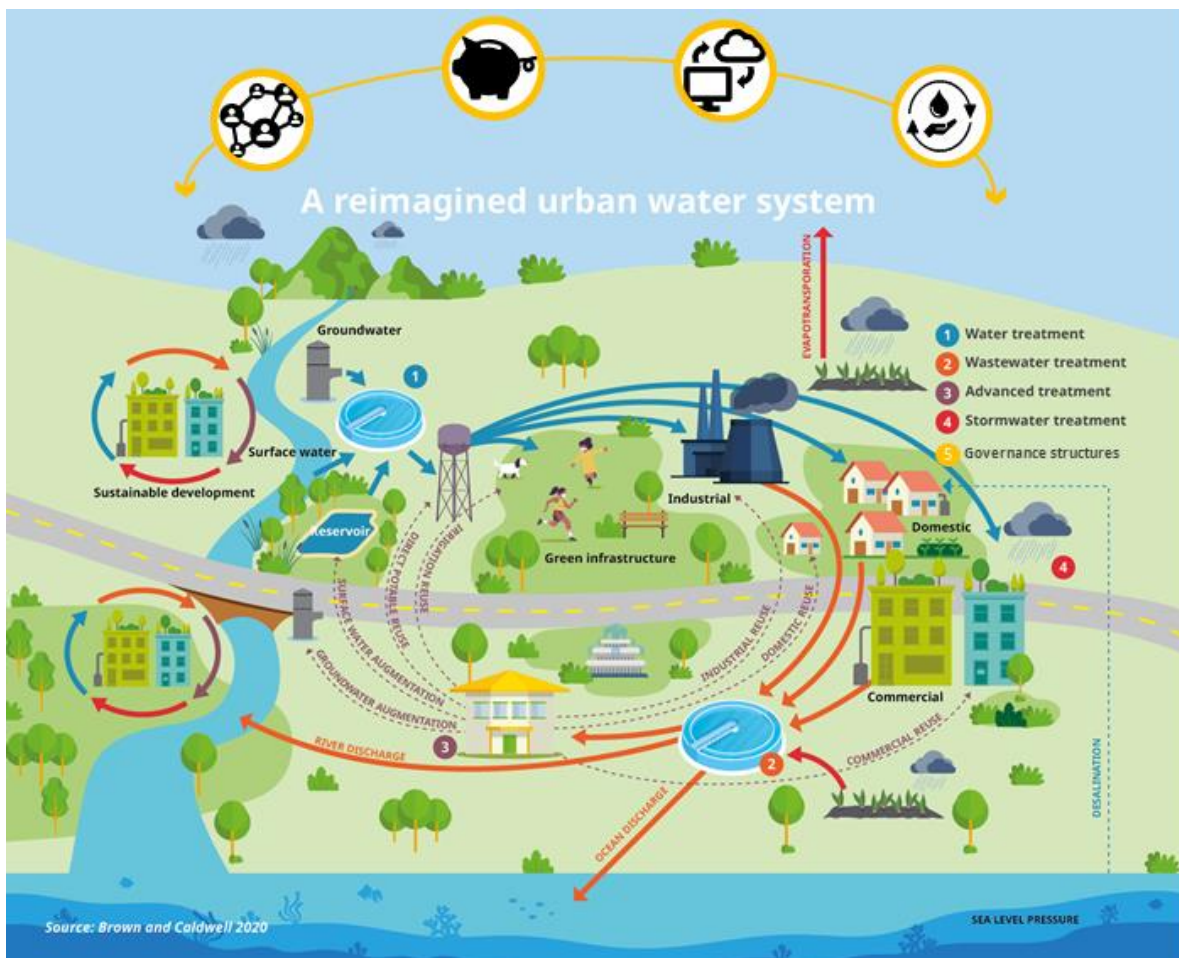


Figure 1: An idealised Urban Water System (Adapted from Brown and Caldwell)

Despite the fact that Johannesburg is situated in a water scarce region, their current water consumption does not seem to be attuned to this reality (12). Johannesburg's average water demand per capita per day was 275l/c/d for 2019/20 financial year compared to a global average of 173l/c/d (13,14). Noting that this average water demand per capita is not a true reflection of the realities of Johannesburg as it includes the consumption of household water users as well as that of the industrial, commercial and institutional water users. The household users are not all the same, there are very contrasting household user groups. For examples the affluent household users have a higher demand and lower regard for water conservation, compared to household users in informal areas, who due to the nature-of and lack-of equity in their water services, who are very low water demand users, see section 3.5 below. In part this lack of aggregation in these water data examples reflects the mostly lack of access to publicly available and aggregated water data. For Johannesburg, depending on the type of water data, access is usually limited and in some case the coverage of data collected is limited. There is a need to centralise this knowledge source and improve the management thereof. As it difficult to accurately identify the true problems without accessible and aggregated data of the urban water system which subsequently limits holistic and targeted solutions design.

At municipal level, Johannesburg's water demand is 18% above the Municipality's limit, as set by Project 1600 (15). Project 1600 is part of Rand Water¹'s Water Conservation and Demand Management Strategy to comply with a 1 600Mm³/annum abstraction limit, for all users including CoJ, until the Lesotho Highlands Water Project's additional water supply becomes available. Moreover, the Municipality has come close to serious droughts several times in the last decade (e.g. 2015 - 2017). During these times, water usage is restricted to essential human and business uses. Droughts, and other climatic variations, in the region are projected to increase in frequency in future decades (11). Thus, highlighting the urgent need for the Municipality to both reduce and more effectively manage the water demand and usage.

While overconsumption is prevalent in the Municipality, there are also communities who do not have adequate and, in some cases, equitable access to water and sanitation services. The Municipality provides different levels of service across the city. Generally, more affluent areas, who have robust access to these services with limited interruptions are those with the largest household water consumers. This highlights the complexity of managing user water demand across the city while ensuring equal and equitable access to water services, in the efforts to improve the quality of life for all.

With regards to water quality, the performance of the water supply treatment works are closely monitored and their results are shared publicly(16). The Municipality has not experienced any major deviations on their water supply quality for several years (13,17). However, the wastewater treatment works have been less compliant since the publishing of more stringent standards for wastewater effluent quality in 2016 (18). In addition to the non-compliant effluent discharge, wastewater spillages, illegal waste dumping and discharge of untreated stormwater also degrade

¹ Rand Water is the water board for Gauteng Province in South Africa, where Johannesburg Municipality is located. See Section 2.4 Johannesburg's Water Cycle Stakeholders

the water quality. These all affect the Municipality's receiving riverine systems and water bodies which ultimately limits the potential for reuse within the urban water system.

These threats and opportunities, as discussed above, were used as an entry point for understanding the current status in Johannesburg Municipality, henceforth referred to as Johannesburg. Using Johannesburg's long-term vision, this Strategy's Strategic Responses and associated actions were designed to guide the Municipality's transition to a resilient, liveable and sustainable, water secure city by 2040. This Strategy document aims to inspire transformative actions. This document discusses the Approach for developing this Strategy in section 2, then describes the Current State of Johannesburg's Urban Water System in section 3 and finally provides the Strategic Responses and actions that should be taken up as part of ensuring the transition to being water secure in City of Johannesburg's Water Security Strategy in section 4.

2 Approach

This section addresses the purpose of this Strategy, the strategic alignment to existing policies and strategies and the approach that was undertaken to develop this Strategy.

2.1 Purpose

Johannesburg's Water Security Strategy, section 4, provides a guideline towards becoming a water secure Johannesburg by 2040. This aim is in alignment with the Johannesburg Growth and Development 2040 Strategy vision (19):

“Johannesburg – a World Class African City of the Future – a vibrant, equitable African city, strengthened through its diversity; a city that provides real quality of life; a city that provides sustainability for all its citizens; a resilient and adaptive society.”

Joburg. My City – Our Future!

This water security strategy outlines Strategic Responses, and associated actions, as a guideline for the City of Johannesburg (CoJ) and its stakeholders to better manage Johannesburg's urban water system on the road to becoming a water secure city. The Strategic Responses were developed based on the issues and challenges identified in Johannesburg and aim to tackle both the current and future scenarios. This strategy builds on existing strategies and policies to offer an aligned approach. The Strategic Responses suggest short- and medium-term actions that lay the foundation for driving long term transformation within Johannesburg. Herein, this strategy also serves as a long-term vision for becoming, and remaining, a water secure Johannesburg by 2040, and beyond.

This strategy has been co-developed through a consultative process with CoJ practitioners, across various departments, and external stakeholders. This strategy will be reviewed and updated periodically leading up to 2040. These updates are intended to readjust and realign the aims of the actions, with the changing circumstances, to ensure Johannesburg remains on the road to becoming a water secure city by 2040.

2.2 Strategic Alignment

This strategy was designed to connect to existing strategies and policies to offer an aligned approach to water security. A detailed review of existing strategies and policies was undertaken as part of the desktop research and is outlined in the Status Quo Report (see Annexure 1: Status Quo Report).

In the context of Johannesburg's urban water system, there are four strategy documents that have the most influence on the Water Security Strategy, namely: the National Water Security Strategy (20), Gauteng City-Region Water Security Plan (12), Joburg 2040 Growth and Development Strategy (19) and CoJ's Water Conservation and Water Demand Management Framework Strategy (21). The relevance of these documents to this Strategy are discussed below.

2.2.1 National Water Security Strategy

National Water Security Framework (NWSF) is a comprehensive strategy that guides different levels of government institutes using an integrated holistic approach towards water security for South Africa (20).

The NWSF outlines the key challenges and water security issues that should be considered when developing water security strategies at sub-national governance levels (20). In addition, the NWSF provides high-level guidance to combat the outlined challenges with overarching principles and focus areas which sub-national institutions should consider when developing water security strategies (20). These challenges and principles were considered in developing this strategy.

2.2.2 The Gauteng City-Region Water Security Plan

The Gauteng City-Region Water Security Plan (GWSP) reflects on Gauteng's current performance and emerging challenges in relations to managing the urban water system. The GWSP then offers overarching strategic responses that Gauteng needs to undertake to address the emerging challenges. The GWSP goes one step further, and outlines action plans tailored specifically for each stakeholders group. Thus, helping each stakeholder group identify their role in achieving a water secure Gauteng.

GWSP uses five programmatic areas of intervention to categorise their strategic response, see the GWSP (12) for details. The GWSP also reflects on urgency by suggesting some priorities are shorter-term such as ensuring and securing additional water sources and managing of water supply and demand. Whereas, building resilient communities that are water secure and able to

manage any risks encountered are longer-term priorities. This strategy used the GWSP strategic response for Gauteng as a guide when designing the Strategic Responses and associated actions for Johannesburg.

2.2.3 Joburg 2040 Growth and Development Strategy

Joburg 2040 Growth and Development Strategy (GDS) in 2011 aims to provide a viable and inspiring future vision of a *World Class African City* (16) for Johannesburg. The 2040 GDS acknowledges uncertainty that contributes to the complexities of planning for a growing city and offered four outcomes. Two of the outcomes include tackling challenges relating to water usage and demand, management of quantity and quality and the overall health of the water environment. Whereas the other two outcomes focus on long term overall system goals towards becoming a holistic and integrated, across sectors and institutions, managed-system. Thus, ensuring sustainable socio-economic growth.

This strategy uses the 2040 GDS as the overarching and guiding vision for Johannesburg, as a whole. This strategy's aims and goals, for a water secure Johannesburg, fit within and align with the 2040 GDS vision.

2.2.4 Water Conservation and Water Demand Management Framework Strategy

The City of Johannesburg's Water Conservation and Water Demand Management (WCWDM) Framework Strategy (21) is pivotal document that brought together various departments across the municipality to extensively define the water issues facing Johannesburg at the time. Most of the issues are still relevant today. The WCWDM Strategy also mapped out a comprehensive list of fifty-eight interventions across five themes namely, Water Resource Management, Distribution Management, Consumer Demand Management, Social Awareness and Education and Management and Institutional Aspects.

This strategy builds on the work undertaken in the WCWDM Framework Strategy. This strategy carried forward all the relevant interventions and developed them further and in alignment with a more holistic approach to managing Johannesburg's urban water system.

2.3 Approach to this Strategy

The approach to this strategy was designed

- To understand and review the current situation and state of the urban water system under the City of Johannesburg's mandate,
- To reflect and identify the key challenges that face the municipality now and in the coming years, and
- To co-develop and co-design key Strategic Responses and associated actions to mitigate the challenges and ensure a water secure Johannesburg.

To achieve the above, the development of the strategy followed these key steps, see **Figure 2** below. Each of the steps are discussed in more detail below.

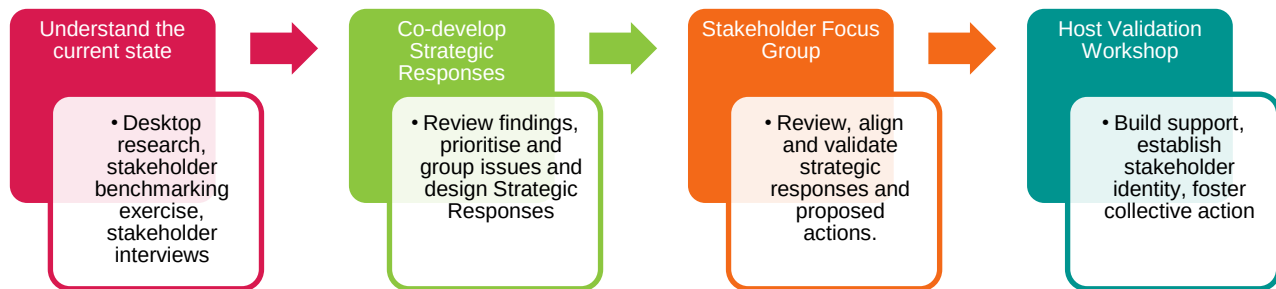


Figure 2: Steps taken to develop the Water Security Strategy

2.3.1 Understanding the current state

To develop a clear picture of the current state of Johannesburg's urban water system, three research components were undertaken, namely desktop research, benchmarking exercise and stakeholder interviews.

2.3.1.1 Desktop Research

Desktop research was undertaken to gain an initial understanding of the current situation and status of the Johannesburg urban water system and all its nuisances. The desktop research involved reviewing existing policy and strategies at national, provincial and municipal levels, that influence any part of Johannesburg's urban water system. The research also reviewed and drew insights from CoJ departmental and municipal entities' reports, such as research, feasibility and investigation studies, risk assessments, business plans, and annual reports that relate to Johannesburg's urban water system.

2.3.1.2 Benchmarking Exercise

A benchmarking exercise was undertaken to gain a deeper understanding of the current situation and status of Johannesburg's urban water system. This was conducted as a participatory and collaborative workshop with CoJ officials and various key stakeholders and organisations from across the water sector. A list of participants is included in the Benchmarking Report (see Annexure 2: Benchmarking Report).

The benchmarking workshop evaluated Johannesburg water sensitivity against the Water Sensitive City Index (WSCI). WSCI was developed by Cooperative Research Centre for Water Sensitive Cities Ltd. The WSCI is a tool used by cities to benchmark their current performance in the water sector against seven Water Sensitive City (WSC) goals. The WSCI is a holistic set of indicators that has been developed through robust academic and applied research which has been successfully implemented in twelve Australian cities, two Chinese cities, one city in Fiji and one in Myanmar and in the City of Cape Town, here in South Africa.

The benchmarking exercise offered an opportunity for various stakeholders across the water sector to reflect together on the status of Johannesburg's urban water system. The results of the benchmarking exercise further validated the findings from the desktop study and offered nuances to the operation and maintenance on the ground, that would not have otherwise been identified.

The benchmarking exercise and the results provide CoJ with a measurable baseline from which to track their future progress. Herein, each WSCI benchmark indicator was assigned to one or multiple, where applicable, Strategic Responses, see section 4. This assignment gives CoJ an indication of current related ratings for each Strategic Response. And gives measurable targets, as part of each indicator's rating scale, to guide the periodic update and review process for this strategy. It also offers CoJ the opportunity to track its process, if and when, CoJ wishes to re-benchmark using the WSCI. Re-benchmarking is recommended every five years.

The results of the benchmarking study are discussed in section 3.5 below and the detailed report can be found in Annexure 2: Benchmarking Report.

2.3.1.3 Stakeholder Interviews

Once the benchmarking results were published, some stakeholder interviews were undertaken with CoJ officials from various departments and officials from the municipal entities working within the Johannesburg's urban water system. These interviews offered the opportunity to stakeholders to validate current findings and the benchmarking marking results, to reflect on the priorities when tackling the issues within the water sector for different stakeholders and to share nuisances and learnings from their perspectives from working in the sector that were not specifically recorded in available documentation.

2.3.2 Co-develop Strategic Responses

Drawing from the desktop study, benchmarking exercise and stakeholder interviews, a visual summary using [Mural](#) was produced, see snapshots of the Findings Mural in **Figure 3**. A larger, high resolution version of the Findings Mural is available in Annexure 3: Findings Mural.

The visual summary separated the urban water system into various aspects namely the physical water flows and supporting water governance structures, or enablers, see top right depiction in **Figure 3**. For each aspect, all the associated details regarding the status and issues and future risks that could influence the aspect were assigned, see left depiction in **Figure 3**.

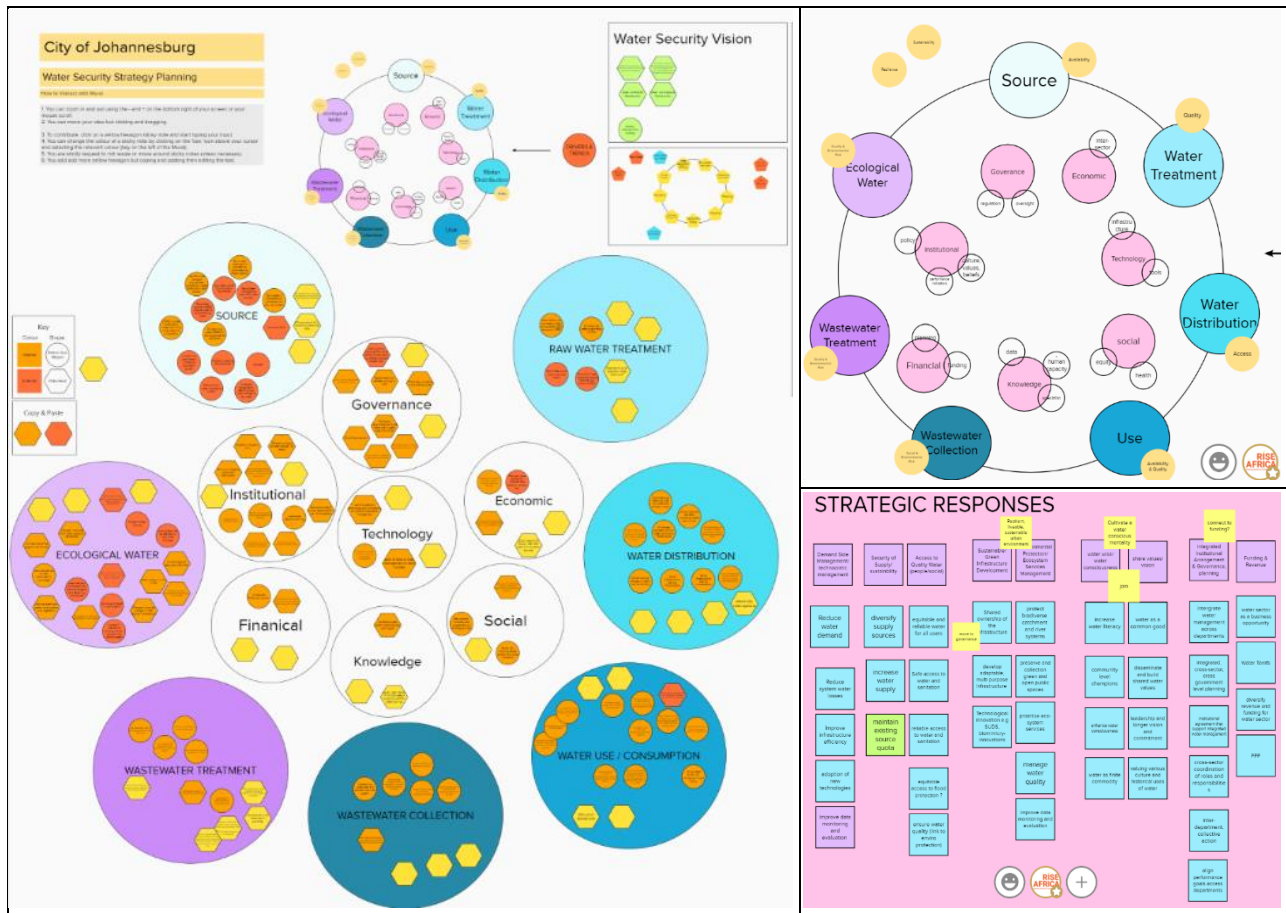


Figure 3: Snapshots of the Findings Mural, see Annexure 3: Findings Mural for the larger high-resolution version

During a Prioritisation Workshop, the Steering Committee validated the findings on mural thus far and added points where they deemed required. Once the visual summary was completed, key actions were extracted and sorted into Strategic Responses, see bottom right depiction in **Figure 3**. These key actions and Strategic Responses form the basis for Johannesburg's Water Security Strategy, explained in detail in section 4.

Once the Strategic Responses and actions were developed, the Steering Committee assigned and urgency rating, a lead stakeholder and key role player for each action, explained in detail in section 4. This process finalised the draft version of the Water Security Strategy.

2.3.3 Stakeholder Focus Groups

The Steering Committee invited groups of stakeholders to various consultative focus groups. In these focus groups, stakeholders were taken through relevant, to the stakeholders, actions for each Strategic Response. Stakeholders had the opportunity to review and help align the suggested actions with stakeholders' mandates, aims and goals leading to 2040. This process was followed as these stakeholders are considered key implementors and/or role players in achieving success of the actions.

This process allowed the Steering Committee to adjust the actions to ensure there is cross-department alignment and to build support towards collective action on achieving a water secure Johannesburg.

2.3.4 Host Validation Workshop

The Steering Committee hosted a final validation workshop to both showcase the collective progress thus far and offer an opportunity for all stakeholders to provide final comment. This process aimed to build the support for this strategy from all CoJ's stakeholder groups, to establish stakeholder identity in each of the strategic responses and ultimately to foster and drive the collective action needed to achieve a water secure Johannesburg by 2040.

3 Current State

This section summarises the current state and situation of Johannesburg's urban water system. It also acknowledges various national, regional, municipal and external stakeholders and their roles and mandates linked to the urban water system. The information is drawn from the desktop research, the benchmarking exercise and the stakeholder interviews.

The operation and management of an urban water system is complex because it comprises both physical aspects and intangible aspects. The physical aspects include the infrastructure, services and environment of the urban water system, and whereas the intangible aspects include water consciousness, data and information, financial and governance structures.

To create a more manageable systems that also simplifies the complexity, the Johannesburg's urban water system was grouped into four aspects, namely, see **Figure 4**,

1. Water Flows – how the water moves in Johannesburg?
2. The Water Environment – how water interacts with natural and man-made systems?
3. Valuing Water – how stakeholders interact with water?
4. Governance Structures – how the municipality interacts with water?

This definition provides smaller groupings relating to the functions, operations and impact on other parts of the system. This definition simplifies the system while allows for clarity when articulating the issues and more specific and relevant remedial actions to be accurately assigned.

The groupings are nested inside one another indicating the interconnections and influence of each grouping. That is, *water flows* are a central component to the urban water system and the functioning of the *water flows* positively, or negatively, influences *the water environment* in which they function. And how stakeholder's *value water* affects both the water flows and *the water environment*. And finally, *the governance structures*, how the municipality interacts with water, impacts the whole system.

This definition also allows CoJ to link identified issues and challenges, and ultimately the remedial Strategic Responses, to the correct part of the urban water system. Consequently, creating more manageable groupings where specific and relevant remedial actions can be applied.

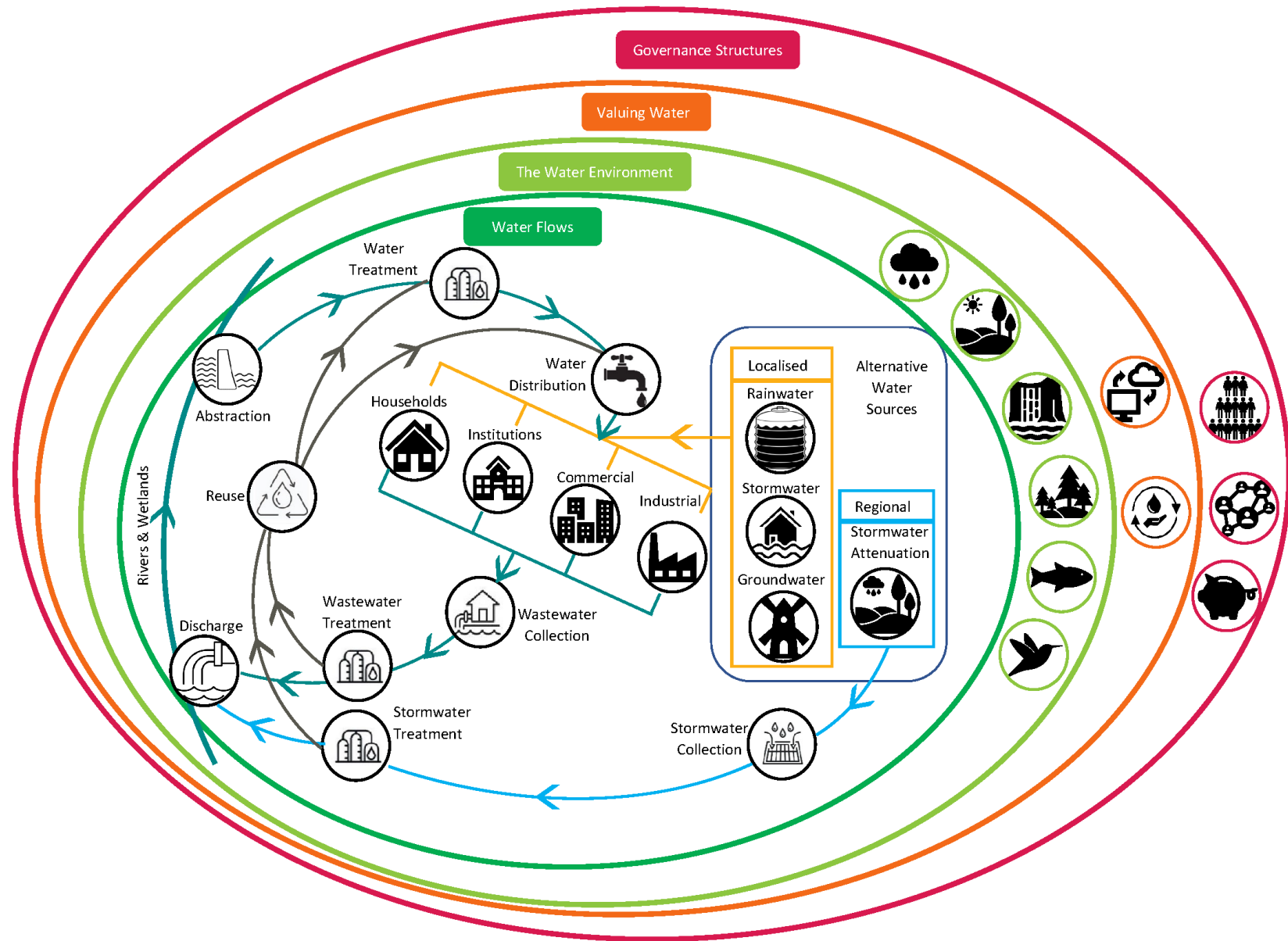


Figure 4: Johannesburg's urban water system

3.1 Water Flows

Johannesburg's water supply comes from outside its municipal boundaries because the municipality is located on a mountain ridge that separates two water catchment areas. Thus, Johannesburg is supplied with water through the Integrated Vaal River System (IVRS) which collects and transports water using transfer schemes coming from the KwaZulu-Natal province and Lesotho.

The Department of Water and Sanitation, DWS, who is the custodian of South Africa's water resources, is responsible for managing the IVRS including the water licencing and water allocations. DWS has allocated ~46% of the IVRS water to Rand Water (RW).

RW is the largest bulk water utility in Africa. It is a state entity that reports to the DWS. It provides bulk potable water to Gauteng, parts of Mpumalanga, the Free State and North-West Provinces. For Johannesburg, RW manages the water supply catchment, water allocations, on behalf of DWS, and the bulk water treatment. Johannesburg uses about 36% of RW's allocation (12).

Thus, RW sells bulk treated water to Johannesburg Water (JW). JW, is a municipal entity owned by CoJ. JW is overseen by the CoJ EISD's Water Services Regulation and Policy Development unit. JW manages the water supply reticulation and the wastewater system. Their mandate is to provide water and sanitation services to the residents of Johannesburg.

Currently JW is purchasing more treated bulk water, e.g. 1616 Ml/d in the 2019/20 financial year (13), than its licenced water allocation of 1322 Ml/d (22). The licenced water allocation is set by RW and the DWS. All the treated bulk water is sourced from surface water supplies.

Subsequently CoJ's water demand per capita per day was 275l/c/d for 2019/20 financial year compared to a global average of 173l/c/d (13,14). Of the bulk water supplied, JW reports 34.5% (in FY 2019/20) as non-revenue water (15).

In terms of access to water and sanitation, JW supplies water at three levels of service, namely (23):

- Level of Service: 1 is the minimum standard for basic services, it supplies water from communal water points; and a ventilated improved pit latrine located on each site;
- Level of Service 2: supplies an unmetered water connection to each stand with an individual yard standpipe, a pour flush toilet and a water borne connection.
- Level of Service 3: supplies a metered full pressure water connection to each stand; and a conventional water borne drainage installation connected to the Council's sewer.

For service level 1, JW reported 93% of informal households have access to basic water services and 43% of informal households have access to basic sanitation services (13). JW aims to supply all outstanding informal households with the basic water services and 2% of outstanding informal households with basic sanitation during financial year 2021/22 (24), increasing the coverage to 100% and 46% of informal household respectively.

In an attempt to manage water losses (part of the non-revenue water) and consumer water usage, CoJ and JW have developed Water Conservation and Water Demand Management Framework

Strategy (21). It is this framework from which JW has implemented various actions such as network pressure management, night flow management, bulk area-level water metering and monitoring, water education campaigns among others.

Johannesburg Roads Agency (JRA) is also a municipal entity, which is overseen by CoJ Transport Department. JRA's mandate is primarily road infrastructure management which also includes stormwater management. In terms of the urban water cycle, JRA is responsible for the bulk stormwater management and has been actively involved with flood and disaster risk management as well as the catchment management work, where there is an overlap with stormwater.

Stormwater management has traditionally focused on moving stormwater out of the city as quickly as possible without considering downstream impact (25). In the last few years, Johannesburg has been experiencing more frequently events, which mainly occur during heavy or extended rainfall events. These flooding events cause disruption to water, sanitation and electricity services as well as impact the health and safety of residents. The latter is due to flood water collecting and transporting of urban pollutants into rivers and water bodies as well as the fast-flowing water damaging infrastructure, property and putting residents at risk of injury or death. Furthermore flooding naturally occurs in low-lying areas, thus, poorer communities who inhabit these areas are disproportionately affected by these flooding events (25).

When considering the future water flows in Johannesburg, there are two main external factors that could have an influence on the availability and quality of these flows, namely future population growth and climate change. CoJ's population is to predicted increase by 45%, by 2050, to ~8.1 million people (11) so the city will need to increase its supply and manage its demand to meet the increased needs of the population. In terms of climate change, the future predicted variations could induce changes in the local temperature, changes in frequency, intensity or even seasonality of rainfall patterns for CoJ which could impact the water supply catchments and availability of water, water demand and water quality (4,6,10).

3.2 The Water Environment

Johannesburg is home to one of the largest man-made urban forests, with an estimated 10 million trees within the municipality (26). Johannesburg has been ranked in the world's ten greenest cities in relation to the percentage of tree and vegetation coverage (27,28). According to GCRO's assessment of Johannesburg land use (29), Johannesburg has 57% surface area coverage of green spaces and green infrastructure.

Despite the somewhat abundant natural assets within Johannesburg municipality, Johannesburg struggles with poor riverine health with the majority of its rivers being ranked between a D (large loss of habitat and basic ecosystem functions) to F (near complete loss of habitat and destroyed ecosystem functions) (27,30,31). In addition, all of Johannesburg's twenty-one wetland types are threatened with thirteen of them that are critically endangered (29).

Johannesburg's poor river health and degrading wetland systems can be largely attributed to illegal dumping into or along waterways and rivers, to poor quality wastewater effluent discharges or sewer spills due to infrastructure failures, to land use changes, acid mine drainage and landfill leachate contamination (26,30).

In Johannesburg illegal dumping of general waste in open spaces is a problem for the Municipality, even though there are several options for waste to be collected and/or dropped-off at municipal waste collection facilities. In 2019, Johannesburg raised, again, the impound fine for illegal dumping in an attempt to curb the problem (32). Dumping of waste affects the health of the riverine and wetland systems, which limits the water reuse potential, affects the health and wellbeing of residents, that live close to and downstream, and natural ecosystems.

With regards to wastewater treatment, JW manages Johannesburg's six Wastewater Treatment Works (WWTW) (15). Collectively, the WWTWs were only 79.9% compliant in the financial year 2019/20. This is a steady increase from previous financial years 77.8% (2018/19), 72.0% (2017/18) (13). According to JW, prior to 2016, the compliance was reportedly higher than 90% compliance, which is the industry target. The decline in compliance is as a result of the more stringent water quality standards for treated effluent set by the new Water Use Licence (Wastewater Treatment Work Permits) (33,34). Beside the compliance, there have been annual operational failures, as reported for at least the last five years, at some of the wastewater treatment plants (13,17,33,34). These failures are either overflows or slippages of wastewater effluent into waterways and river systems, which affect the water quality.

As Johannesburg's population grows, there will be more demand for more infrastructure and development to support the Municipality's growth. Whether the Municipality advocates for densification and upgrading of existing urban environments or allows greenfield sites to be developed, it is important for CoJ to ensure land use change positively influences the landscape. That is, for example, CoJ's development control policies and protocols should ensure policies and guidelines like Nodal Review Policy (35) and Johannesburg Spatial Development Framework (36) are adhered to. These policies advocate for between 10% - 20% of neighbourhood, node or zones should be functional open space, recreational facilities and greening (for example parks, squares, playgrounds, sport fields, etc.), especially for new development (35,36). There is a need to determine how to enforce similar regulations for developments that aim to upgrade existing infrastructure and urban environments. By advocating for functional open space or water sensitive infrastructure and design principals (such as Water Sensitive Urban Design (WSUDS), Sustainable Urban Drainage Systems (SuDS), among others) to be implemented in development, CoJ will be ensuring natural systems that treat urban water, manage stormwater, promote infiltration and recharge of ground water are promoted and enhanced. Thus, increasing alternative water reuse options and increasing flood protection across the municipality.

3.3 Valuing Water

Valuing water reflects on how Johannesburg's stakeholders interact with water, both in terms of understanding the urban water system and having a sense of ownership and responsibly to

protect it. Valuing Water includes data and information management, capacity development and water consciousness of stakeholders.

3.3.1 Data and Information

Currently for Johannesburg's urban water system, Johannesburg Water collects and monitors the water supply data, including the revenue and non-revenue water, and some wastewater data. Some of the data is publicly available in annual reports. However, there are data gaps, possibly recorded but not publicly available, relating to the abstraction and usage of alternative water supply streams such as recycled treated wastewater effluent, rainwater and stormwater harvesting and groundwater abstraction. There is also limited access, lack of aggregation or limited coverage of some water data especially related to water quality, the number of people that have access to water services, usage per user type, among other data sources see section 4.

3.3.2 Capacity Development

Various CoJ departments and their municipal entities conduct water related investigations and feasible studies to improve the operations and management of the Johannesburg urban water system. In addition, there are several stakeholders from research institutions, private businesses and NGOs, who as part of their business also conduct various research related to urban water systems. These stakeholders include University of Witwatersrand, Water Research Commission, C40 Cities Climate Leadership Group, Gauteng City Region Observatory, Water Aid, Council for Scientific and Industrial Research, to name a few. Despite the wealth of available knowledge, there is limited sharing of findings and learning. Knowledge sharing could streamline research objectives, prevent potential duplications and enhance a common practise. It could also aid in furthering capacity development across the water sector and aid the overall improvement of the urban water system towards a more resilient, liveable and sustainable city.

3.3.3 Water Consciousness

Water Consciousness is best reflected by the Municipality's water demand per capita, which as stated earlier is relatively high for South Africa and compared to the global average. This gives an indication that the value of water, as an expression of willingness to save and conserve water, is relatively low in the Municipality. It could be due to the relatively low cost of water compared to the price it costs the Municipality to supply water. Or a lack of knowledge or understanding about how to be more water conscious or about the importance for all residents and stakeholders to individual and collectively use water wisely.

In addition, the infrastructure and development within the Municipality has historically prioritised supplying water services separately by different departments or municipal entities. Which means there has been little integration and little opportunity to include co-benefits, like resilience and sustainability, in infrastructure implementation. However there has been a shift toward including more, for example, water sensitive design principles and practises in existing and future

developments. These principles and practices are being included in the newer or updated versions of the Municipality's policies and strategy documents (23,30,35,37,38).

3.4 Governance Structures

The Governance Structures reflects on how the municipality interacts with water, which relate to the Municipality's institutional arrangements and structure, the financial structures and the stakeholder engagement. These three aspects all underpin good water governance and holistic management of the urban water system.

3.4.1 Institutional Arrangements

Johannesburg's urban water system is managed fragmentally on different levels by different departments or entities.

This Water Security Strategy is led by a CoJ Environment and Infrastructure Services Department (EISD) steering committee. This committee consist of representatives from EISD's Water Services Regulation and Policy Development, Catchment Management, Biodiversity Conservation, and Open Space Planning units. These units are responsible for collectively driving this strategy and its strategic responses towards achieving a water secure Johannesburg, among other responsibilities.

In terms of the water flows, Rand Water (RW) manages the water catchment, raw water treatment and water allocations on behalf of Johannesburg. JW, who is overseen by EISD's Water Services Regulation and Policy Development unit, manages the water supply, sanitation and wastewater management and treatment for Johannesburg. Johannesburg Roads Agency (JRA), who reports to CoJ Transport Department, is responsible for managing stormwater within Johannesburg. CoJ EISD's Water Regulation and Policy Development unit current coordinates and drives the investigation into alternative supplies with the support from DWS, RW, JW and JRA.

In addition, there are multiple other CoJ departments and units whose goals and mandates directly impact the urban water system and thus the success of this strategy. These departments and units are included as leads or role players of the proposed action associated with each Strategic Responses in section 4. The following departments and units are included, in alphabetic order, Johannesburg City Parks and Zoo, CoJ Revenue, CoJ Transport, Citizen Relationship and Urban Management, Joburg Innovation and Knowledge Exchange (CRUM), Knowledge Centre, Development Planning, Disaster Management, EISD (Awareness and Stakeholder Management), EISD (Climate Change), EISD (Waste Management), Environmental Health, Group Communications, Group Strategy Policy Coordination and Relations Department (GSPCR), Housing, Human Resources, Johannesburg Development Agency, Johannesburg Metropolitan Police Department (JMPD), Johannesburg Social Housing Company (JOSHCO), and Pikitup.

3.4.2 Financing

Public service provision is financed by tax revenue, tariff income, development contributions and high-level government funding allocations. The governmental institutions are mandated to effectively use the available funds to manage current and future infrastructure needs. The planning and allocation of funding is currently included in the Integrated Development Plan (IDP) for Johannesburg, which is updated annually for a five-year term.

Many of departments and units that manage, operate or maintain part of the urban water system, report financing as being a barrier for effective implementation both for day-to-day maintenance and larger upgrade and capital project funding (39).

3.4.3 Stakeholders Engagement

This strategy has been developed in collaboration with CoJ's stakeholders across the municipality, at district and national level actors as well as local non-government stakeholders.

The government stakeholders were discussed above in section 3.4.1: Institutional Arrangements. For the purposes of this strategy the non-governmental stakeholders have been divided into four groupings namely:

- **Academia:** universities, academics, research institutions
Those who research issues and develop solutions to advise and guide the municipality and others
- **Practitioners:** Private Sector, Consultants, Community-Based Organisations, Non-Governmental Organisations
Those who help define and identify the issues, design and develop solutions and sometimes implement solutions.
- **Organisational Users:** Industrial, Commercial and Institutional water users
These are larger organisations that can work with the city to advocate for change and lead by or be the example for others.
- **Households Users:** domestic, residential, individual water users
Those are smaller private water users.

These groupings are used to indicate where non-government stakeholders play a key role in the actions of the Strategic Responses.

3.5 Benchmark Results and Findings

Figure 5 shows all 34 indicators and their associated rating for the overall Johannesburg. The indicators are group into seven overarching goals towards becoming a water sensitive city. The scores shown below are the overall Johannesburg ratings. However, 17 of 34 indicators were scored separately for formal and informal areas of the municipality as significant inequities exist in developing cities like Johannesburg. These indicators are shown with a dashed outline in **Figure 5**.

The definition of formal and informal is based on the Statistics South Africa definitions indicating the percentage of households in formal and informal areas. For Johannesburg, 81.4% is considered formal and 18.6% is considered informal. This percentage split was used to calculate a weighted average for an overall rating for Johannesburg, see Annexure 2: Benchmarking Report for further details on informal and formal ratings and scores.

The scores for individual indicators for overall Johannesburg range from 1.5 at the lowest and 3.5 for the highest, with an average individual score of 2. Noting indicator 3.1 equitable access to safe and secure water supply rated the highest and then 7.6 Adequate Maintenance was rated the lowest. Which both correlate with other desktop data showing that Johannesburg is quite good at providing access to water services, as this is the municipality's main focus, but maintenance of infrastructure is a problem.

Scoring Scale								
1	1.5	2	2.5	3	3.5	4	4.5	5
1. Ensure good water sensitive governance	2. Increase community capital	3. Achieve equity of essential services	4. Improve productivity and resource efficiency	5. Improve ecological health	6. Ensure quality urban space	7. Promote adaptive infrastructure		
1.1 Knowledge, skills and organisational capacity	2.1 Water literacy	3.1 Equitable access to safe and secure water supply	4.1 Benefits across other sectors because of water-related services	5.1 Healthy and biodiverse habitat	6.1 Activating connected pleasant urban green and blue space	7.1 Diverse fit-for-purpose water supply system		
1.2 Water is key element in city planning and design	2.2 Connection with water	3.2 Equitable access to safe and reliable sanitation	4.2 Low GHG emissions in water sector	5.2 Surface water quality and flows	6.2 Urban elements functioning as part of the urban water system	7.2 Multi-functional water systems infrastructure		
1.3 Cross-sector institutional arrangements and processes	2.3 Shared ownership, management and responsibility of water assets	3.3 Equitable access to flood protection	4.3 Low end- used potable water demand	5.3 Groundwater quality and replenishment	6.3 Vegetation coverage	7.3 Integration and intelligent control		
1.4 Public engagement, participation and transparency	2.4 Community preparedness and response to extreme events	3.4 Equitable and affordable access to amenity values of water-related assets	4.4 Water-related business opportunities	5.4 Protect existing areas of high ecological value		7.4 Robust infrastructures		
1.5 Leadership, long-term vision and commitment	2.5 Indigenous involvement in water planning		4.5 Maximised resource recovery			7.5 Infrastructure and ownership at multiple scales		
1.6 Water resourcing and funding to deliver broad societal value							7.6 Adequate maintenance	
1.7 Equitable representation of perspectives	City Wide	Formal /Informal						

Figure 5: WSCI Benchmark Indicators colour coded according to the scoring from the benchmarking workshop

For the seven overarching water sensitive goals, overall Johannesburg scored highest average for goal 3: Achieve equity of essential services (2.8 average) followed by goal 1: Ensure good water sensitive governance (2.7 average), with a tie for the lowest score (2.2 average) between goal 6: Ensure quality urban space and 7: Promote adaptive infrastructure. These average scores are also indicative of the desktop data showing that service provision (goal 3) currently takes precedence over ensuring sustainability and resilience in the whole urban water cycle (goals 6 & 7). As goals 6 and 7 focus more on the co-benefits of the functional and well-maintained water environment as part of the whole urban water system. The relatively high average score for goal 1 is surprising as water governance is depicted in the desktop data as a problem area due to the siloed management of the urban water system as well as the lack of data, knowledge sharing, finance and values. However, the higher average score could be attributed to the robust policies and programmes that exist to support good water governance however the implementation and actioning thereof is lacking in Johannesburg.

The scores have provided a measurable baseline for CoJ to track their future progress. Thus, each indicator has been assigned to one or multiple, where applicable, Strategic Responses, see section 4 below. This assignment gives CoJ an indication of current related ratings for each Strategic Response. And provides measurable targets, as each indicator has a specific rating scale. These targets will guide the periodic updates and review processes for this strategy while offering CoJ the opportunity to track its process.

4 City of Johannesburg's Water Security Strategy

Section 3 above provides a clear picture of the current state and situation of Johannesburg urban water system using the four groupings, namely the Water Flows, The Water Environment, Valuing Water and Governance Structures, see **Figure 6**. The Water Flows encompasses the understanding of how water flows in terms of supply, demand and equity as these aspects are largely managed per water system phase by one responsible body. Then the Water Environment, both urban and ecological, which is managed in parts by different departments within the Municipality, reflects on how water interacts with the natural and man-made systems. Following this, is understanding how stakeholders interact with water, i.e. Valuing Water, which is the responsibility of a larger grouping of municipal officials, CoJ's stakeholders and users. And finally, acknowledging how the municipality interacts with water, i.e. how effective water governance influences the functioning of the urban water system. These groupings simplify some of the complexity within the system and create more manageable groupings to which specific and relevant remedial actions can be applied.

For Johannesburg to achieve its water security goals, it broadly needs to assure stability of its water availability (quantity), access and quality in all aspects of its urban water system while ensuring the health of its urban and ecological environment that should be supported by good urban water governance practises and a water conscious population. To achieve this, seven Strategic Response Goals with two-three detailed Strategic Responses per goals, see **Figure 6**, were designed. These Strategic Responses were derived from identified key actions during the prioritisation workshop.

The Strategic Responses are applied to different parts of the urban water system, see **Figure 6**, to ensure a holistic and system approach towards achieving a water secure Johannesburg.

In the following section all the Strategic Responses are defined. Each Strategic Response identifies the challenge it is tackling, a target it aims to work towards by 2040, the associated benchmarking indicators and several recommended actions and some examples. Each Action has an urgency rating, a lead and responsible role players assigned.

The aims of the Strategic Responses are set to be achieved for 2040, to align with Johannesburg's Growth and Development Strategy 2040 timelines and goals. The aims and associated actions are intended to be realistic and to align with existing mandates and goals of stakeholders across the urban water system. Thus, the aims and the associated actions were workshopped with, at least, all stakeholders assigned as leads and/or role players.



Figure 6: Johannesburg's Strategic Responses

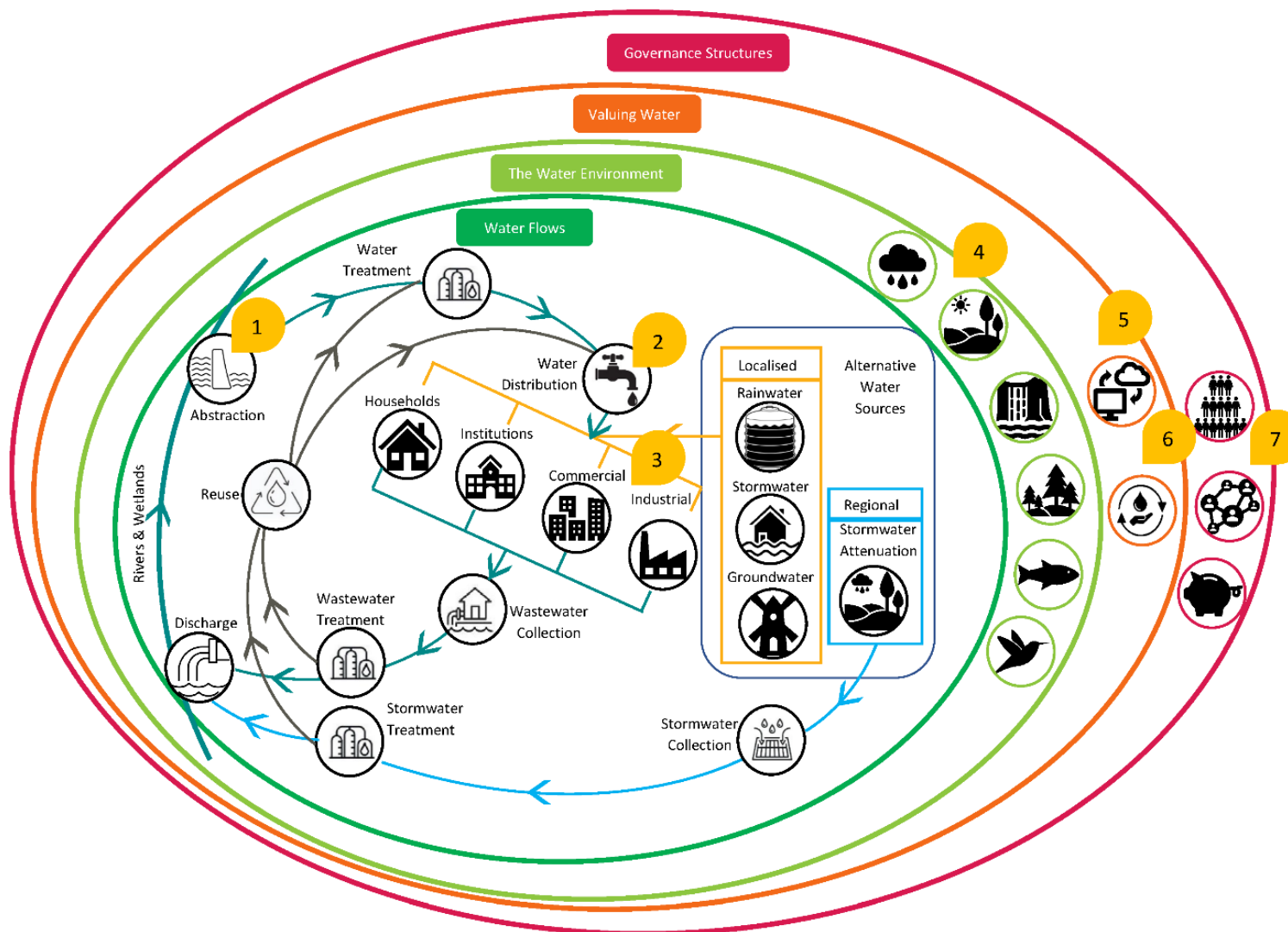


Figure 7: Johannesburg's Urban Water System and Strategic Response Goals

The assigned lead/s per action are responsible for driving the action whereas the role players are instrumental and direct role in undertaking the actions and ensuring their successful implementation.

The urgency rating indicates when each recommended action aims to be undertaken. The categorisation labels are critical, high, moderate and low; their associated period and term can be seen in **Figure 8** below. These rating were also workshopped with stakeholders to ensure the timelines align with existing and future plans and mandates.

Categorisation labels	Period	Term (years)
Critical	Immediate	0 – 2
High	Short term	2 – 5
Moderate	Medium term	5 – 10
Low	Long term	10 – 19

Figure 8: Strategic Responses urgency label categorisations

This Strategy was designed to have short and medium actions that lay the foundation for longer term transformation. By striving to achieve the aims for each of the Strategic Responses, CoJ and its stakeholders will be *en route* to becoming a water secure Johannesburg.

The CoJ Steering Committee endeavours to periodically review and updated this Water Security Strategy to readjust and realign the aims of the actions to ensuring a water secure Johannesburg by 2040 and beyond.

4.1 How water moves in Johannesburg

Johannesburg is reliant on surface water supplied from outside its municipality boundaries. The Municipality is currently using more than its licenced allocation likely due to its high per capita demand, and relatively high water losses. To make matters worse, the city's population is projected to almost double by 2050 as well as changes in the local climate is expected to cause higher temperature and more heat waves, variable and unpredictable rainfall patterns, among other effects. These changes would increase the water demand which puts more strain on the existing infrastructure and already limited water supply.

To tackle the challenges and mitigate these effects on Johannesburg's urban water system; CoJ must improve:

- the management of its current and future supply and demand to ensure the urban water system is resilient and sustainable,
- the water and sanitation service delivery to ensure equality and equitable access for all, and
- the forecasting and planning of future scenarios and risks

The following three Strategic Responses, detailed below, aim to address the above: SR1 - Secure the Water Supply, SR2 - Manage water demand and losses and SR3 - Ensure access to safe, reliable and equitable water services.

SR1. Secure the Water Supply	
1.1. Manage source water licence allocation	
Purpose	Benchmark indicators
Rand Water and the Department of Water and Sanitation manage the catchment water sources on behalf of CoJ, as these sources are outside of the municipal boundaries. CoJ should actively oversee the management of these sources to ensure all risks are being considered and mitigated. Thus, ensuring the existing water licence allocations and potential future water licence allocation is maintained.	Undertaking the actions in this strategic response, the following indicators will be improved: 3.1 Equitable access to safe and secure water supply 3.2 Equitable access to safe and reliable sanitation 5.4 Protect existing areas of high ecological value 7.3 Integration and intelligent control
Aim for 2040	
CoJ aims to ensure their water allocation license limit is maintained for Johannesburg.	

Actions	Urgency	Lead	Role Players
Continuous monitoring and analysis of the current and future risks that could influence the current water licence allocation at a catchment level Such of the risks include variations in rainfall, temperature, alien invasive vegetation, land-use changes, increasing demand from neighbouring municipalities, delayed implementation of the Lesotho Highlands Water Project (LHWP), among others	High	Rand Water	EISD (Water and Biodiversity), Johannesburg Water
Advocate for, encourage and support policies and practises that will maintain, and potentially increase, the water allocation quantity, at the catchment level, for example: - Encourage water conservation efforts that limit water wastage and losses, and mitigate environmental degradation - Advocate and support feasibility studies and pilot projects of alternative water supplies at the catchment level - Continue bi-monthly meeting with Rand Water	Critical	EISD (Water and Biodiversity)	Rand Water, Johannesburg Water
Develop and implement methods to enable continuous monitoring and analyse the municipality's water needs and usage patterns in conjunction with projected current and future risks.	Critical	Johannesburg Water	EISD (Water and Biodiversity)
1.2. Diversify water supply sources			
Purpose	Benchmark Indicators		
Johannesburg's water supply is reliant on surface water sources. Johannesburg must diversify its water sources to build resilience into its urban water system. CoJ has made some efforts towards investigating the feasibility of alternative supplies.	Undertaking the actions in this strategic response, the following indicators will be improved: 3.1 Equitable access to safe and secure water supply 3.2 Equitable access to safe and reliable sanitation 4.4 Water-related business opportunities 4.5 Maximised resource recovery 7.1 Diverse fit-for-purpose water supply system 7.3 Integration and intelligent control		
Aim for 2040			
CoJ aims to diversify its surface water supply sources and include more non-surface water sources.			

Actions	Urgency	Lead	Role Players
Rainwater harvesting - Continue existing research and investigation into potential use of rainwater harvesting through demonstration projects - Incorporate, and enforce, the implementation of local water source supply for large new developments in conjunction with Stormwater by-laws	High	EISD (Water and Biodiversity)	Johannesburg Water, Development Planning, Housing
Groundwater - Design, implement and formalise a single registration procedure for all users to be captured on the same database thus allowing for more effective monitoring of groundwater replenishment, storage and quality - Implement groundwater abstraction register and monitoring programme - Investigate feasibility of metering and implementing oversight officers to manage and regulate groundwater misuse or polluting - Continue existing research into potential use of groundwater to augment city-level water demand through demonstration projects, e.g. implement the planned augmentation of water supplies for public parks and pools	High	EISD (Water and Biodiversity)	Department of Water and Sanitation, Johannesburg Water, Johannesburg City Parks and Zoo, Housing, Development Planning
Stormwater - Continue to investigate the viability of localised-source vs regional stormwater harvesting by implementing pilot projects - Address institutional management of stormwater to more effectively coordinate stormwater management - Continue the development of catchment management plans for all catchments across CoJ	Moderate	EISD (Water and Biodiversity)	Johannesburg Roads Agency, Johannesburg Water
Treated Effluent for non-potable uses - Monitor and evaluate the feasibility of reusing treated effluent for both direct reuse for potable purposes and indirect reuse for non-potable purposes - Uptake and acceptance of using treated effluent to diversity non-potable water supplies	Critical	Johannesburg Water	Department of Water and Sanitation, EISD (Water and Biodiversity), Rand Water, Johannesburg City Parks and Zoo, Practitioners, Organisational Users
Commission the existing and implement additional semi-treated/polished water reuse systems	High		
Continue to investigate and implement direct reuse	Moderate		
Acid Mine Drainage - Continue to monitor the effects on water sources and water bodies - Continue to investigate the potential for treatment and reuse	Moderate	Department of Water and Sanitation, EISD (Water and Biodiversity)	Johannesburg Water, Rand Water Academics, Practitioners, Organisational Users

Advocate for and encourage innovation and development of technologies to enable diversification of water sources for both organisational and household water users to implementation	Moderate	EISD (Water and Biodiversity)	Johannesburg Water, Academics, Practitioners, Organisational Users, Household Users
<u>Useful Resources</u> CoJ's Water Conservation and Water Demand Management Framework Strategy (21), CoJ Environmental Sustainability Strategy and Action Plan (30), National Water Security Strategy (20), Treated Effluent By-law (40), Water Safety Plan (41)			
SR2. Manage water demand and losses			
2.1. Reduce end-user water demand			
Purpose	Benchmark indicators		
Johannesburg's water demand per capita is the highest in South Africa and about 1.5 times the world average per capita. Johannesburg must reduce their water demand to aid reducing pressure on the municipality's limited water supplies.	Undertaking the actions in this strategic response, the following indicators will be improved: 4.3 Low end- used potable water demand 4.5 Maximised resource recovery 7.3 Integration and intelligent control		
Aim for 2040			
CoJ aims to reduce the water demand per capita from its current 275l/c/d ² , in 2020, towards the global average 175l/c/d ³ in alignment with the CoJ Climate Action Plan 2050 goal 2 ⁴ .			
Actions	Urgency	Lead	Role Players
Record demand per capita and aggregate for each water user group (i.e. households, commercial, industry and institutional).	Critical	Johannesburg Water	EISD (Water and Biodiversity)

² From Johannesburg Water Annual Report 2019/20 (13)

³ 175 l/c/d is the global average (13,14)

⁴ As part of the CoJ Climate Action Plan, Goal 2: A climate Resilient City (10)

Continue to design and implement water education, awareness and behaviour change programmes - Identify co-benefits of saving water and how to save and use water wisely for each water user category - Encourage the use of water sensitive and saving principles, practises and technologies for each water user category - Share targeted suggestions, design guideline and/or best practise for each water user category such as Water Use Efficiency Guideline for high- and middle-income households from WCWDM Strategy - Advocate for sustainability curriculums to be included in all levels of educations from primary through into continued professional development and institutional and sector capacity building - Publish per capita consumption regularly to keep citizens accountable - Publishing personal user consumption rates compared to city target consumption rates e.g. percentage overuse	Critical	Johannesburg Water	EISD (Water and Biodiversity), CRUM, JIKE (Knowledge Centre), Housing, JOSHCO
Encourage water users to report water misuse or wastage and dumping or polluting in waterways and water bodies Investigate viability of a dedicated community reporting service for water related issues	Critical	EISD (Water and Biodiversity)	Johannesburg Water, Household Users, Organisational Users, Practitioners
Continue to monitor, remove and retrofit wasteful and/or leaking water devices beyond the municipal meter, inside the user's boundary for low-income households, as was proposed by WCWDM Strategy intervention called Indigent Leak Repair Programmes	Critical	Johannesburg Water	EISD (Water and Biodiversity), JOSHCO, Household users
Investigate potential mechanisms and incentives that could optimise water conservation practises while preserving municipal financing structure. E.g. investigating the viability "off-grid" systems, incentives for usage of water saving devices	Critical	EISD (Water and Biodiversity)	Johannesburg Water, CoJ Revenue Team
During drought periods, reinstate the drought tariffs and other water saving management tools as per the Drought Management Plan Ensure the Drought Management Plan is reviewed and update regularly	Critical	Johannesburg Water	EISD (Water and Biodiversity)

2.2. Reduce water distribution losses			
Purpose	Benchmark indicators		
Johannesburg's non-revenue water losses account for 39.4% ⁵ of the total water supplied to the municipality. JW and CoJ must oversee a reduction in non-revenue water both to conserve valuable water resources and recover potential revenue for the infrastructure.	Undertaking the actions in this strategic response, the following indicators will be improved: 1.6 Water resourcing and funding to deliver broad societal value 4.4 Water-related business opportunities 4.5 Maximised resource recovery 7.3 Integration and intelligent control 7.4 Robust infrastructures		
Aim for 2040			
CoJ aims to achieve and maintain a non-revenue water percentage of 33% by 2040, in alignment with the CoJ's CAP (30).			
Actions	Urgency	Lead	Role Players
Improve water data analysis throughout the urban water system to better identify and mitigate potential infrastructure issues - Map all data collected, sources and responsible parties relating to the urban water system - Plan and budget for improving and upgrading existing systems and implement new systems where data collection and monitoring systems are missing	Critical	EISD (Water and Biodiversity)	Johannesburg Water, Johannesburg Roads Agency
Continue, scale-up and improve asset maintenance planning and implementation to prevent waste losses through bursts, leakages and faulty or non-existent meters - Investigate and implement improved leak detection programs e.g. using GIS imaginary to identify major leaks - Advocate for up-to-date asset registers and maintenance plans as a performance indicator - Continue to review and update short, medium- and long-term infrastructure maintenance and management plans - Ensure responses and repairs of reported or detected leaks are prioritised	High	EISD (Water and Biodiversity)	Johannesburg Water, Rand Water, Academics, Practitioners

⁵ From Johannesburg Water 2021 Non-revenue Water Table

Maintain existing pressure management infrastructure and establish more pressure management areas as per the Water Conservation and Demand Management Framework Strategy to reduce losses and water usage	Critical	Johannesburg Water	EISD (Water and Biodiversity)
Acceptance and use of new technologies to aid better monitoring and reduce water losses - Keep up-to-date on technological advances to improve efficiency and effectiveness of water management - Ensure all water users are billed correctly, maintain, improve and upgrade billing system	High	Johannesburg Water	EISD (Water and Biodiversity), JOSHCO, CoJ Revenue, Practitioners, Large Water Users, Household Users
<u>Useful Resources</u> CoJ's Climate Action Plan (10), CoJ's Water Conservation and Water Demand Management Framework Strategy (21), CoJ Environmental Sustainability Strategy and Action Plan (30), National Water Security Strategy (20), Environmental Awareness Campaign Framework (42)			
SR3. Ensure access to safe, reliable and equitable water services			
3.1. Access to water supply and sanitation services			
Purpose	Benchmark indicators		
As of 2020/21 financial year, 93% and 45% of informal housing has basic (level of service 1) access to water supply and sanitation services respectively. The overall city-wide access is 99% for water services and 93% for sanitation services. CoJ and JW aim to address the backlog which will ensure equitable access to safe and reliable water services for all.	Undertaking the actions in this strategic response, the following indicators will be improved: 3.1 Equitable access to safe and secure water supply 3.2 Equitable access to safe and reliable sanitation 7.6 Adequate maintenance		
Aim for 2040			
Johannesburg Water aims to ensure all informal households have access to basic water supply services (100% water access city wide) and to ensure an increase in access to sanitation services for informal households (95% sanitation access city wide) by 2040.			
Actions	Urgency	Lead	Role Players
Continue to rigorously monitor and evaluate drinking water quality across the system (e.g. water treatment plant, bulk supply and network samples) to ensure safe access to water services	Critical	EISD (Water and Biodiversity)	Johannesburg Water, Rand Water
Continue and improve monitoring and evaluation of water flows and pressure throughout the water supply network to ensure reliable access to water and sanitation services	Critical	EISD (Water and Biodiversity)	Johannesburg Water, Rand Water

Investigate options of possible supply from alternative energy sources as backup, for when the municipal electricity supply is unavailable, to prevent interruptions in water services	Critical	Johannesburg Water	EISD (Water and Biodiversity), Rand Water
Ensure regular maintenance of non-network water and sanitation services, where required Regular refilling of water tanks, clearing and cleaning of pit latrines and maintenance of ablution blocks and communal taps	High	Johannesburg Water	EISD (Water and Biodiversity)
Continuous monitoring and evaluation of the population dynamics and projected future water and sanitation service needs to ensure planning and rollout of water services is efficient and meets the needs of the citizens Continue and improve monitoring of level of service of household users to ensure equitable access to water services	High	Johannesburg Water	EISD (Water and Biodiversity), Housing, JOSHCO
Advocate for and support the transition of households from level of service 1 toward level of service 3 (or similar equitable technology) to ensure equitable access to water services	Moderate		
Uptake and usage of alternative and/or new technologies for sanitation solutions that align with level of service 3 that are water wise, sustainable and robust	Moderate	EISD (Water and Biodiversity)	Johannesburg Water, Practitioners, Organisational Users
Regularly review and update water and sanitation services policies, regulations, design guidelines and oversight	Moderate	EISD (Water and Biodiversity)	Johannesburg Water, Rand Water
3.2. Access to flood protection			
Purpose	Benchmark indicators		
Flood protection is not a basic service however it affects all citizens. Parts of Johannesburg formal areas have access to flood protection however other parts of formal areas and all informal areas do not have access. CoJ should aim to mitigate flooding thus ensuring safe, reliable and equitable access to flood protection for all.	Undertaking the actions in this strategic response, the following indicators will be improved:		
Aim for 2040	2.4 Community preparedness and response to extreme events	3.3 Equitable access to flood protection	5.1 Healthy and biodiverse habitat
CoJ aims to prevent development in high risk flood zones and to continue to provide access to reliable and equitable flood protection.	7.4 Robust infrastructures	7.3 Integration and intelligent control	

Actions	Urgency	Lead	Role Players
Create an oversight and compliance role, within the CoJ institutional arrangement, for stormwater management - Clearly define roles, responsibility and oversight for each aspect of stormwater management - Improve coordination and communication where functions are held across various departments	Critical	EISD (Water and Biodiversity)	CoJ Transport, Johannesburg Roads Agency, Disaster Management
Invest in monitoring and evaluation of the quantities of stormwater, state of the flood infrastructure (stormwater infrastructure and services), household access to infrastructure - Ensure improved maintenance management and future planning and development - Ensure infrastructure is design-for-purpose including capacity and functionality - Ensure regular and timely maintenance of infrastructure	Moderate	EISD (Water and Biodiversity)	Johannesburg Roads Agency, Academics, Practitioners
Investigate the feasibility of an early warning notification system to prepare for flooding events and inform citizens of high flood risks.	High	EISD (Water and Biodiversity)	Johannesburg Roads Agency, Disaster Management, Academics, Practitioners
Continuous monitoring and regular updating of flood mapping for Johannesburg in relation to future projected climate risks and population dynamics, among other factors Extend the existing mapping of flood zones to include smaller 1-in-20-year floods	High	EISD (Water and Biodiversity)	Johannesburg Roads Agency, Disaster Management, Academics, Practitioners
Review, coordinate and manage regional (municipal) and local (neighbourhood/erf) stormwater infrastructure and services - Review, update and maintain accurate stormwater infrastructure asset registers - Identify key areas within each node or zone in CoJ where local and regional stormwater infrastructure exists or should be implemented - Advocate for dual purpose infrastructure that improves stormwater management	High	EISD (Water and Biodiversity)	Johannesburg Roads Agency, CoJ Transport, Development Planning, Department of Water and Sanitation, Gauteng Department of Agriculture and Rural Development

Better enforcement and regulation regarding development (formal and informal) within and near high-risk flood zone areas through policy, regulation and oversight • Ensure development control agents and personal are equipped and capacitated to mitigate and prevent development within high risk flood zones • Regulate and manage informal development in and along flood risk zones • Managing the relocation of informal settlements while lie within flood zones	High	EISD (Water and Biodiversity)	Development Planning, CoJ Transport, Johannesburg Roads Agency, Housing, Gauteng Department of Agriculture and Rural Development
<u>Useful Resources</u> CoJ Water Services By-laws 2021, CoJ Sanitation Policy 2021 (38), CoJ GIS Hazard and Vulnerability Maps, SABS Drinking Water Standards 2015 (43), National Water Act , CoJ's Water Conservation and Water Demand Management Framework Strategy (21)			

4.2 How water interacts with natural and man-made systems

Johannesburg has an abundance of green spaces and green infrastructure however its river and wetland systems are in a dire state. CoJ needs to drastically improve the health of these system because they are essential ecological infrastructure for water security, as well as food security, tourism, recreation and natural disaster risk reduction (44). The riverine systems store and transport water supplies, remove pollutants and provide cultural and lifestyle services (45). Wetland systems purify water, regulate water flows, support biodiverse ecosystem habitats and offer aesthetic and lifestyle services (45).

Furthermore, the man-made urban environment, including future developments, need to promote and enhance the functioning of these natural systems and assets. In doing so, the urban environment can unlock potential alternative water sources, mitigate flooding and manage urban temperatures (reducing water demand), among other cross-sectoral benefits.

The following Strategic Response, detailed below, aims to address the above: is SR4 - Promote resilient, liveable and sustainable urban water environment.

SR4. Promote resilient, liveable and sustainable urban water environment	
4.1. Sustain the system's water quality	
Purpose	Benchmark indicators
Johannesburg has poor river and wetland health which reduces the opportunities for reuse of urban water to supplement Johannesburg's current supply. CoJ can improve the health of these systems by addressing the water quality issues within the urban water system.	Undertaking the actions in this strategic response, the following indicators will be improved:
Aim for 2040	3.4 Equitable and affordable access to amenity values of water-related assets 4.5 Maximised resource recovery 5.1 Healthy and biodiverse habitat 5.2 Surface water quality and flows 5.3 Groundwater quality and replenishment 5.4 Protect existing areas of high ecological value
CoJ aims to reach class D (large loss of natural habitat and some changes in basic ecosystem functions) percentage quality compliance in riverine systems and 97% compliance of the green drop reporting by 2040.	

Actions	Urgency	Lead	Responsible persons
Continue regular monitoring, evaluation and reporting of river water quality at various points in the catchment. - Expand existing network of measurement points - Investigate the feasibility and effectiveness of reinstating same day auditing (by CoJ) of water quality tests in the rivers and water bodies	Critical	EISD (Water and Biodiversity)	Environmental Health, Johannesburg City Parks and Zoo, Department of Water and Sanitation
Ensure stormwater and runoff does not pollute water ways and water bodies: - Keep up-to-date and review stormwater by-laws and policies in relation to mitigating and prevent pollution of rivers and water bodies. - Enforce and apply stormwater by-law and manual in relation to water quality - Ensure all planning approvals comply with stormwater and environmental water quality regulations - Investigate the feasibility of purposely treating of poor-quality stormwater through both manmade and nature-based solutions	Critical	Johannesburg Roads Agency	EISD (Water and Biodiversity and Transport), Development Planning, JMPD, Environmental Health, Academics, Practitioners, Organisational Users, Household Users
Mitigate and prevent pipe burst, spillages, leakages and overflows of sewerage from wastewater infrastructure from entering stormwater infrastructure, water ways and water bodies - Improve wastewater discharge monitoring, regulation and compliance - Continuous use of green drop monitoring programme and expanding the monitoring and reporting - Improve planning and implementation for maintenance and upgrades for wastewater infrastructure	Critical	Johannesburg Water	EISD (Water and Biodiversity)
Mitigate and prevent general waste from entering water ways and water bodies - Keep up-to-date, review and enforce by-laws and policies to prevent and mitigate pollution sorting, waste generation and waste dumping in and alongside flood plains, river and water bodies - Implement and enforce of the Waste Management Strategy and Plan - Regular monitoring of landfill leachate and its effect on groundwater - Enforcing compliance and policing of illegal dumping and waste generation - Ensure adequate infrastructure is available for effective waste management - Equip enforcers to be able to effectively police regulations and by-laws to prevent and mitigate waste affecting the water quality of the urban water system	Critical	EISD (Waste Management)	Pikitup, EISD (Water and Biodiversity), JMPD, Academics, Practitioners, Organisational Users, Household Users
Ensure all development promotes and enhances water security - Mitigate and prevent informal development along river, in flood plains linked to the management of informal development - Ensure continuous formalisation and regulation of informal settlements	High	EISD (Water and Biodiversity)	Development Planning, Housing, Johannesburg Development Agency, Johannesburg Water, Johannesburg Roads Agency, Gauteng Department of Agriculture and Rural

			Development, Academics, Practitioners, Organisational Users, Household Users
4.2. Protect the ecosystem amenities			
Purpose	Benchmark indicators		
Johannesburg's population, and thus urbanisation and development, is expected to increase in the coming years. This could prompt land use change from natural to impermeable surfaces which will increase runoff and decrease infiltration causing more flooding, allowing more pollutants to enter the urban water system and potentially reduce the groundwater recharge. CoJ needs to preserve its existing green and public spaces to protect its ecosystem amenities which include flood reduction, groundwater recharge and water purification which all promote achieving a water secure Johannesburg.	Undertaking the actions in this strategic response, the following indicators will be improved: 3.4 Equitable and affordable access to amenity values of water-related assets 5.1 Healthy and biodiverse habitat 5.4 Protect existing areas of high ecological value 6.1 Activating connected pleasant urban green and blue space 6.3 Vegetation coverage		
Aim for 2040			
CoJ aims to preserve its existing green and public open spaces as well as mitigate unsustainable development that will lead to the loss of ecosystem amenities.			
Actions	Urgency	Lead	Role Players
Continuously monitor and update maps of existing high-value ecological water areas such as recharge and infiltration areas, water feeder areas, hydrological pathways, rivers, their banks and flood plains, among others	Critical	EISD (Water and Biodiversity)	Johannesburg City Parks and Zoo, Development Planning
Ensure planning and development regulations and by-laws and the approval protocols and mechanisms align with water security and sustainable development goals that support sustainable water management - Develop a process and protocol document that equips development control and approval personal with data and knowledge to ensure applications are compliant with water sensitive principles and preserving water sensitive areas - Ensure land use change does not increase runoff, decrease recharge and/or cause flooding - Advocate for the use of sustainable urban drainage systems - Ensure development does not occur within high risk flood zones specially along rivers and water bodies where development must not influence the natural water systems and services	Critical	EISD (Water and Biodiversity)	Development Planning, Johannesburg Roads Agency, Johannesburg Development Agency, Gauteng Department of Agriculture and Rural Development, Practitioners

• Ensure new developments and/or amendments and upgrades include the required percentage of green space as spatulated in the Johannesburg Spatial Development Framework 2040 and the CoJ Nodal Review Policy • Advocate to increase the required percentage of green space for new developments.			
4.3. Integrate urban infrastructure and innovations			
Purpose	Benchmark indicators		
CoJ must build adaptability, resilience and sustainability into its urban water management. This is done by integrating more nature-based and water sensitive design principles and practises into planning and development of Johannesburg and into this infrastructure design. Some of the co-benefits include improve water infiltration, groundwater and aquifer recharge, stormwater and flood management, improved water quality of urban water runoff and resource efficient infrastructure. This would aid in preserving the urban water flows and provide opportunities to diversify water sources.	Undertaking the actions in this strategic response, the following indicators will be improved: 1.2 Water is key element in city planning and design 2.2 Connection with water 3.4 Equitable and affordable access to amenity values of water-related assets 4.2 Low GHG emissions in water sector 5.3 Groundwater quality and replenishment 6.2 Urban elements functioning as part of the urban water system 7.1 Diverse fit-for-purpose water supply system 7.2 Multi-functional water systems infrastructure 7.4 Robust infrastructures		
Aim for 2040			
CoJ aims to integrate more multi-purpose, resource efficient, nature-based and water sensitive infrastructure.			
Actions	Urgency	Lead	Role Players
Develop design guidelines and best practises for each of the seven node and development zone types within CoJ to encourage and advocate for the application of water sensitive design principles and practises that are relevant and specific to each node or zone. • Investigate the feasibility of using the above design guidelines and best practises as minimum standards for new developments or upgrades. • Retro-fit all municipal buildings as demonstration projects • Continue to advocate for densification within the municipality boundaries	Moderate	EISD (Water and Biodiversity)	Development Planning, Housing, Johannesburg Development Agency, Gauteng Department of Agriculture and Rural Development

Build capacity and enable build environment and urban practitioners on the use and inclusion of water sensitive principles and practises in urban development that promotes and enhances water security in Johannesburg	Critical	EISD (Water and Biodiversity)	Rand Water, Development Planning, Housing, Johannesburg Road Agency, JOSHCO, Gauteng Department of Agriculture and Rural Development, Practitioners, Academics
<u>Useful Resources</u> CoJ's Environmental Sustainability Strategy and Action Plan (30), Greening and Green Infrastructure Strategy for City of Johannesburg (26,29), CoJ Waste Treatment and Disposal Strategy, CoJ Biodiversity Strategy and Action Plan 2015 (46), National Biodiversity Assessment 2018 (44), Integrated Urban Development Framework (47), Draft National Climate Change Adaptation Strategy, National Environmental Management Act, Stormwater By-law (48), Water Services By-law (23), CoJ Vehicle Emissions Control Strategy 2019, CoJ's Water Conservation and Water Demand Management Framework Strategy (21), CoJ Spatial Development Framework (36), Johannesburg Build Environment Guidelines and Standards (49), CoJ Nodal Review Policy (35).			

4.3 Understanding and valuing water

Johannesburg's urban water system data is fragmented, both in terms of gaps in data and in management and operation of the urban water system, latter discussed in the next section. There is some high-quality data but often it is not easily accessible. There are also large gaps in the data collection. Without comprehensive data, covering all aspects of the urban water system, Johannesburg will struggle to properly articulate efficiency, or inefficiency, of its urban water system's functions and where needed effectively identify the root causes and extent of issues that arise. This limits effective resource planning and management.

More comprehensive data would allow Johannesburg to better manage its resource flows, to improve its identification of root causes and locations of issues, to improve the effectiveness of its targeted education and demand management campaigns, to improve budgeting and financial planning for future scenarios, to better identify opportunities for alternative water supply flows, among other benefits.

Despite the wealth of available knowledge, there is limited sharing of findings and learning between internal municipal officials and external stakeholders which could aid in furthering capacity development across the water sector and aid in improving the urban water system. Thus, there is a need to leverage knowledge partnerships and strengthen the community of practise within the water sector in order to enhance holistic solutions development and management practises. This would assist Johannesburg in reaching its water security goals.

In order to tackle these issues, CoJ Strategic Responses, discussed in detail below, are SR5 - Manage water systems knowledge and data and SR6 - Nurture a water conscious society.

SR5. Manage water systems knowledge and data	
5.1. Enable the water sector's community of practise	
Purpose	Benchmark indicators
There is a limited sharing of findings and learning that could benefit Johannesburg's urban water system's operation and management. CoJ needs to leverage knowledge partnerships to streamline relevant knowledge and strengthen the water sector community of practise.	Undertaking the actions in this strategic response, the following indicators will be improved:
Aim for 2040	1.1 Knowledge, skills and organisational capacity 1.3 Cross-sector institutional arrangements and processes 1.4 Public engagement, participation and transparency 2.1 Water literacy 2.3 Shared ownership, management and responsibility of water assets
CoJ aims to enable co-creation and sharing of knowledge that will improve Johannesburg's water security.	

Actions	Urgency	Lead	Role Players
Improve sharing of knowledge between internal and external partners and stakeholders to enhance development - Create feedback, knowledge sharing and reporting forums, platforms or committees to share findings and learnings - Integrate learnings from research and private practise - Share learnings from non-governmental organisations - Educate and capacitate CoJ about new technologies and methodologies for better operation and management of the urban water system - Streamline solutions development	Critical	EISD (Water and Biodiversity)	Department of Water and Sanitation, EISD (Awareness and Stakeholder Management), JIKE (Knowledge Centre), Group Communications, CRUM, Academia, Practitioners, Organisational Users, Household Users
Advocate for and enable co-creation of knowledge by leveraging knowledge partnerships within the municipality and between municipal entities and outside stakeholders E.g. Using students' work experience or projects to better understand water related problems or test solutions	Critical	EISD (Water and Biodiversity and Climate Change)	Department of Water and Sanitation, Johannesburg Water, Johannesburg Roads Agency, Housing, Development Planning, JIKE (Knowledge Centre), Academia, Practitioners
5.2. Collect and manage water data			
Purpose	Benchmark indicators		
Johannesburg has gaps in the water data and lacks the oversight management of the existing water data. Water data is needed to properly understand how water moves in its urban water system and what external factors might influence the system. This would allow CoJ to more effectively mitigate risks and utilise opportunities.	Undertaking the actions in this strategic response, the following indicators will be improved: 1.1 Knowledge, skills and organisational capacity 7.1 Diverse fit-for-purpose water supply system 7.2 Multi-functional water systems infrastructure 7.3 Integration and intelligent control 7.4 Robust infrastructures 7.6 Adequate maintenance		
Aim for 2040			
CoJ aims to have quality urban water system data that is easily accessible to decision makers.			
Actions	Urgency	Lead	Role Players
Establish an updated detailed urban water system balance of all the flows throughout the system.	Critical	EISD (Water and Biodiversity)	Johannesburg Water, Johannesburg Road Agency, Rand Water, Department of Water and Sanitation

Develop and manage a centralised data system for the urban water system that is transparent and accessible. - Advocate and fund personal and/or a unit to manage the central data system - Analyse and oversee the data to aid better development of monitoring, evaluation and learning metrics to be included as performance indicators or future budgeting and planning.	Critical	EISD (Water and Biodiversity)	GSPCR
Continue existing and ensure resources are available to incorporate missing data collection for all aspects of the urban water system: - Map all data collected, sources and responsible parties relating to the urban water system - Identify gaps and missing datasets to efficiently understand and diagnosis issues and design solutions for the urban water system	Critical	EISD (Water and Biodiversity and Climate Change)	Johannesburg Water, Johannesburg Roads Agency, Housing, Development Planning, JIKE (Knowledge Centre)
Advocate for including data collection and management into strategic goals and/or key performance indicators	Critical	EISD (Water and Biodiversity)	GSPCR, Johannesburg Water, Johannesburg Roads Agency, Housing, Development Planning
<u>Useful Resources</u> CoJ's Environmental Awareness Campaign Framework (42), CoJ's Water Conservation and Water Demand Management Framework Strategy CoJ's Environmental Sustainability Strategy and Action Plan (30).			
SR6. Nurture a water conscious society			
6.1. Increase water literacy			
Context	Benchmark indicators		
CoJ's urban water system has various issues such as high end-user water demand, dumping of solid waste in river systems, blocking of stormwater drainage, informal development in high-risk flood zones, among others. CoJ needs to increase water consciousness among the city officials, its stakeholders and the citizens to ensure conservation, protection and sustainable management of the urban water system.	Undertaking the actions in this strategic response, the following indicators will be improved: 1.1 Knowledge, skills and organisational capacity 2.1 Water literacy 2.2 Connection with water		
Aim for 2040			
CoJ aims to capacitate the water sector and its users to ensure water secure practises throughout the urban water system.			

Actions	Urgency	Lead	Role Players
Advocate for and actively participate in CoJ Environmental Awareness Forum on behalf of urban water system	Critical	EISD (Water and Biodiversity)	Johannesburg Water, Johannesburg Roads Agency, EISD (Environmental Awareness), Rand Water
Continue and scale-up education and public awareness programmes that build water literacy and water consciousness of citizens to reduce water demand, mitigate polluting of water ways and water bodies, mitigate flood impacts and conserve water	Moderate	EISD (Water and Biodiversity)	Johannesburg Water, Rand Water, Johannesburg Roads Agency, GSPCR, JIKE (Knowledge Centre), CRUM, Academics, Practitioners
Advocate for and support developing relevant capacities within the municipality to better understand, operate and manage the urban water system and its interconnections	High	EISD (Water and Biodiversity)	GSPCR, JIKE (Knowledge Centre), Johannesburg Water, Rand Water, Johannesburg City Parks and Zoo, Johannesburg Roads Agency
Encourage and enable immersive ways to build ownership of the urban water system by citizens thus enhancing water consciousness, protection of urban water systems and mitigation of pollution - Using public open space, parks and dual-purpose infrastructure to encourage ownership and protection of the natural water ways and water bodies - Mainstream messaging across Johannesburg parks and zoo facilities - Develop information billboards about water cycles and conservation - Support and encourage sustainable eco-tourism	High	EISD (Water and Biodiversity)	GSPCR, Johannesburg Water, Rand Water, Johannesburg City Parks and Zoo, Johannesburg Roads Agency
6.2. Share water value and vision			
Context	Benchmark indicators		
The value of water is not shared extensively throughout Johannesburg because the urban water system is mostly managed by CoJ's water service delivery functions and does not include environmental and social functions. CoJ must develop a shared water value and vision to encourage action and guide all stakeholders to manage and operate in way that promotes water security and resilience within Johannesburg.	Undertaking the actions in this strategic response, the following indicators will be improved: 1.1 Knowledge, skills and organisational capacity 1.5 Leadership, long-term vision and commitment 2.2 Connection with water 2.3 Shared ownership, management and responsibility of water assets		
Aims for 2040			
CoJ aims to ensure water security is everybody's business.			

Actions	Urgency	Lead	Role players
Co-develop clear water values and a water vision to be shared across departments and water stakeholders engaging with the water sector, the urban water system and the water security strategy	Critical	EISD (Water and Biodiversity)	Group Communications, CRUM, Environmental Health
Equip and empower water community champions, business champions, local ward leaders and municipal champions to aid in disseminating and demonstrate incorporation of the water values and vision	High	EISD (Water and Biodiversity)	Johannesburg Water, CRUM, GSPCR, JIKE (Knowledge Centre), Practitioners, Organisational Users, Household Users
<u>Useful Resources</u> CoJ's Environmental Awareness Campaign Framework (42), CoJ's Water Conservation and Water Demand Management Strategy Framework (50), CoJ's Environmental Sustainability Strategy and Action Plan (30)			

4.4 How the municipality interacts with water

CoJ needs to ensure that its institutions and governance structures support, guide and influence the water sector are coordinated and share one vision. Without a shared vision and goal, there is lack of ownership and responsibility toward action. It is important to ensure all stakeholders in institutions and governing roles, especially inter-departmental, understand the context and aims of the strategy (10). This ensures these stakeholders are empowered with the knowledge through deliberate capacity development.

Additional risks include misalignment of institutional culture with the mission and values of organisations and its employees. This could be caused by inadequate succession planning, ineffective performance and consequence planning and management, undesirable working conditions, among others. This could lead to insufficient or ineffective human capital and unethical behaviour, which affects service delivery, tariff revenue, strategic planning, opportunities to establish equitable solutions, environmental compliance, among others (18,21,30,44,50).

Public service provision is financed by tax revenue, tariff income and higher-level government funding allocations. These governmental institutions are mandated to effectively use the available funds to manage current and future infrastructure needs.

Without enough funding to ensure timely maintenance and upgrades as well as expansion of the infrastructure system, the institutes will either create debt or neglect less urgent maintenance. This would create delayed and additional consequences to the infrastructure system, such as increasing leakages in the aging infrastructure, reduced opportunities to provide equitably services as institutions are focus on provide only basic services, additional traffic income losses, among others. In additional, ineffective maintenance could affect water quality, affecting public health or available water supply.

In order to tackle these issues, CoJ Strategic Response, discussed in detail below, is SR7 - Achieve coordinated good water governance.

SR7. Achieve coordinated good water governance	
7.1. Improve internal coordination	
Purpose	Benchmark indicators

Johannesburg urban water system is managed fragmentally in silos and lacks an oversight department for the entire urban water system. CoJ needs better inter-departmental alignment and support to streamline and enable efficient operation, management and problem mitigation related to the urban water system.	Undertaking the actions in this strategic response, the following indicators will be improved: 1.1 Knowledge, skills and organisational capacity 1.2 Water is key element in city planning and design 1.3 Cross-sector institutional arrangements and processes 1.5 Leadership, long-term vision and commitment 1.7 Equitable representation of perspectives 2.3 Shared ownership, management and responsibility of water assets 4.1 Benefits across other sectors because of water-related services 7.5 Infrastructure and ownership at multiple scales		
Aim for 2040			
CoJ aims to ensure efficient mandates are established and inter-department and -sectoral coordination mechanisms operate effectively.			
Actions	Urgency	Lead	Role Players
Improve organisational integration - Investigate the viability of a water security task team versus an overseeing urban water system department - Advocate for a response person and/or team of people to manage and store the urban water system data in a data management system - Monitor, evaluate and adapt processes and institutional arrangements in alignment with changing circumstances and new insights - Delineate roles and responsibilities especially where overlapping mandates exist and embed in practise - Ensure effective succession planning - Improve intra- and inter-departmental planning and risk management	Critical	EISD (Water and Biodiversity)	Governance, GSPCR, Johannesburg Water, Johannesburg Roads Agency, Human Resources, Housing, Development Planning, Johannesburg Development Agency, Gauteng Economic Development Department
Improve internal information sharing, collaborative management and capacity development - Improve water consciousness and buy-in across departments and hierarchical levels - Increase internal capacity development - Allow data to be share across departments	Critical	EISD (Water and Biodiversity)	EISD (Awareness and Stakeholder Management), JIKE (Knowledge Centre), Group Communications, CRUM, Johannesburg Development Agency, Gauteng Economic Development Department

Advocate for and enable aligning performance goals to the goals and objective of a water secure Johannesburg for all persons engaged with or related to Johannesburg's urban water system Prevent misalignment of goals and objectives	High	EISD (Water and Biodiversity)	GSPCR
Ensure existence of and maintain the existing water related policies and regulations that govern and enable a water secure urban water system. - Ensure policy and regulations are inclusive and comprehensive for the urban water system - Maintain a policy and regulation database and register - Regularly review policies - Close the gap and develop new policies and regulation where needed - Enable and ensure the enforcement of water policy and regulations across sectors	Critical	EISD (Water and Biodiversity)	Governance, GSPCR, Johannesburg Metropolitan Police Department
7.2. Improve multi-stakeholder governance			
Purpose	Benchmark indicators		
Johannesburg urban water system is managed fragmentally across municipal departments and entities CoJ needs intra-department support and actions to ensure a long-term sustainable water system.	Undertaking the actions in this strategic response, the following indicators will be improved: 1.4 Public engagement, participation and transparency 1.5 Leadership, long-term vision and commitment 1.7 Equitable representation of perspectives 2.3 Shared ownership, management and responsibility of water assets 2.5 Indigenous involvement in water planning 4.4 Water-related business opportunities		
Aim for 2040			
CoJ aims to include diverse stakeholder consultations in the planning, design and implementation of the urban water system.			
Actions	Urgency	Lead	Role Players
Advocate for long-term leadership and commitment across departments and sectors - Ensure the water security vision aligns and benefits all related departments mandates - Ensure buy-in and support from stakeholders to achieving a water secure Johannesburg - Monitor, review and update visions - Continuous engagement with internal and external stakeholder	High	EISD (Water and Biodiversity), GSPCR	All Stakeholders

Enhance stakeholder (practitioners and citizens) engagement • Ensure stakeholder consultation are inclusive and representative of the municipality's demographics • Ensure stakeholder engagement is ongoing and frequent • Co-develop and share accountability with partners and stakeholders • Regularly review and update stakeholder databases	High	EISD (Water and Biodiversity)	GSPCR, EISD (Awareness and Stakeholder Management)
7.3. Financing water security			
Purpose	Benchmark indicators		
CoJ has relatively high unaccounted for water causing losses in revenue. CoJ is accustomed to stretched or underfunded budget forcing entities to phase maintenance and upgrade plans. There is need to maintain current and secure alternative funding for the water system.	Undertaking the actions in this strategic response, the following indicators will be improved: 1.6 Water resourcing and funding to deliver broad societal value 4.4 Water-related business opportunities 7.5 Infrastructure and ownership at multiple scales		
Aim for 2040			
CoJ aims to improve the revenue collection and to develop costed implementation plans to fund all the proposed actions to achieve a water secure Johannesburg.			
Actions	Urgency	Lead	Role Players
Map finance flows for Johannesburg's water infrastructure and urban water system to understand the gaps and highlight the opportunities for funding maintenance and new development requirements.	Critical	EISD (Water and Biodiversity)	Johannesburg Water, Rand Water, Department of Water and Sanitation, CoJ Revenue
Improve the revenue recovery from users • Improve analysis of water usage to ensure monthly meter readings are accurate • Ensure accurate volumes and correct type of billing and tariffs are applied to all water users • Investigate potential revenue from fines due to illegal connections, among other offense against water polices and by-laws • Investigate potential minimum user or access to water services tariffs	Critical	EISD (Water and Biodiversity)	Johannesburg Water, Rand Water, Department of Water and Sanitation, CoJ Revenue
Ensure enough maintenance and capital funding is available to support the transition to a water secure Johannesburg • Continue to motivate for, from provincial and national budgets, capital and maintenance funding through existing budgeting mechanisms • Forecast funding requirements for the strategic response actions, indicating minimum requirements for each financial year to achieve goals of the strategy	High	EISD (Water and Biodiversity)	Development Planning, Johannesburg Water, Johannesburg Roads Agency, Johannesburg Development Agency

• Ensure holistic and realistic short, medium and long-term maintenance and capital plans with their associated funding, governance and resource requirements are developed for all aspects of the urban water system • Ensure planning is in alignment with Integrated Development Plans			
Investigate opportunities to diversify revenue • Investigate green and climate related funding opportunities for improving sustainability and water security of the urban water system • Investigate alternative innovate funding mechanism • Encourage and enable public-private partnership to aid diversifying local on-site water sources including policy development and legislation	High	EISD (Water and Biodiversity)	CoJ Revenue, Johannesburg Water, Johannesburg Roads Agency, Practitioners, Organisational Users
<u>Useful Resources</u> CoJ's Water Conservation and Water Demand Management Framework (21)			

5 Concluding reflections and way forward

Johannesburg is an asset and of great importance to the South African economy, as Johannesburg is the largest and fastest growing city as well as the economic hub of the country. However, Johannesburg, like many large cities, bears growing and development struggles. Johannesburg's population is growing and is predicted to almost double by 2050. With this growth, Johannesburg will undergo more urbanisation and development to meet the needs of its population. In addition, climate change is also predicted to impact Johannesburg's temperature, rainfall, storm frequency, flooding and drought patterns. Thus, Johannesburg must strategically plan and mitigate the negative effects of these future scenarios while ensuring its continued growth and prosperity.

This strategy reflects on how the above factors would negatively affect the urban water system in Johannesburg. This urban water system which underpins both the lives of the population as well as the industries that support Johannesburg's existence. This strategy, through extensive engagement of various stakeholders across the city, has defined the current status and challenges within the municipality. Some of the challenges include high end-user water demand, high water losses within the system, limited and stretched supply, aging infrastructure, lack of diversified water supply, fragment management with limited access to water data, and limited integration across sectors even within the municipality, among others.

To tackling these and ensure long term sustainability, the municipality wants to become a *World Class African City of the Future* aligned with the Johannesburg's Growth and Development 2040 Strategy. This vision prioritises the quality of life for all citizens through building a sustainable, resilient and adaptive municipality. Aligned to this vision, the CoJ must become a water secure city. Which entails ensuring the quantity and quality of water to sustain the livelihoods, wellbeing, and socio-economic development of the municipality. To achieve this, this strategy offers the CoJ and its stakeholders a road map with overarching goals and detailed strategic responses with aims and actions, as detailed in section 4.

Figure 9 illustrates the overarching goals and the detail Strategic Responses. These goals, aims and actions were co-developed with various stakeholder across the municipality to ensure alignment with various mandates and to foster the vision of becoming a water secure city.

This strategy is the long-term vision that will help disseminate transformative action. Through this strategy, the CoJ is committing to take action in transforming Johannesburg into a sustainable, resilient and adaptive city. This strategy should be used as the guiding document, road map, to inform CoJ and its stakeholders. CoJ and its stakeholders will continue their work together in developing the detailed action plans for short- and medium-term implementation. This strategy aims to be adaptive and will be periodically reviewed to realign the aims and amend the recommended actions.

Join us, on the road to becoming a water secure city!

City of Johannesburg Water Security Strategy

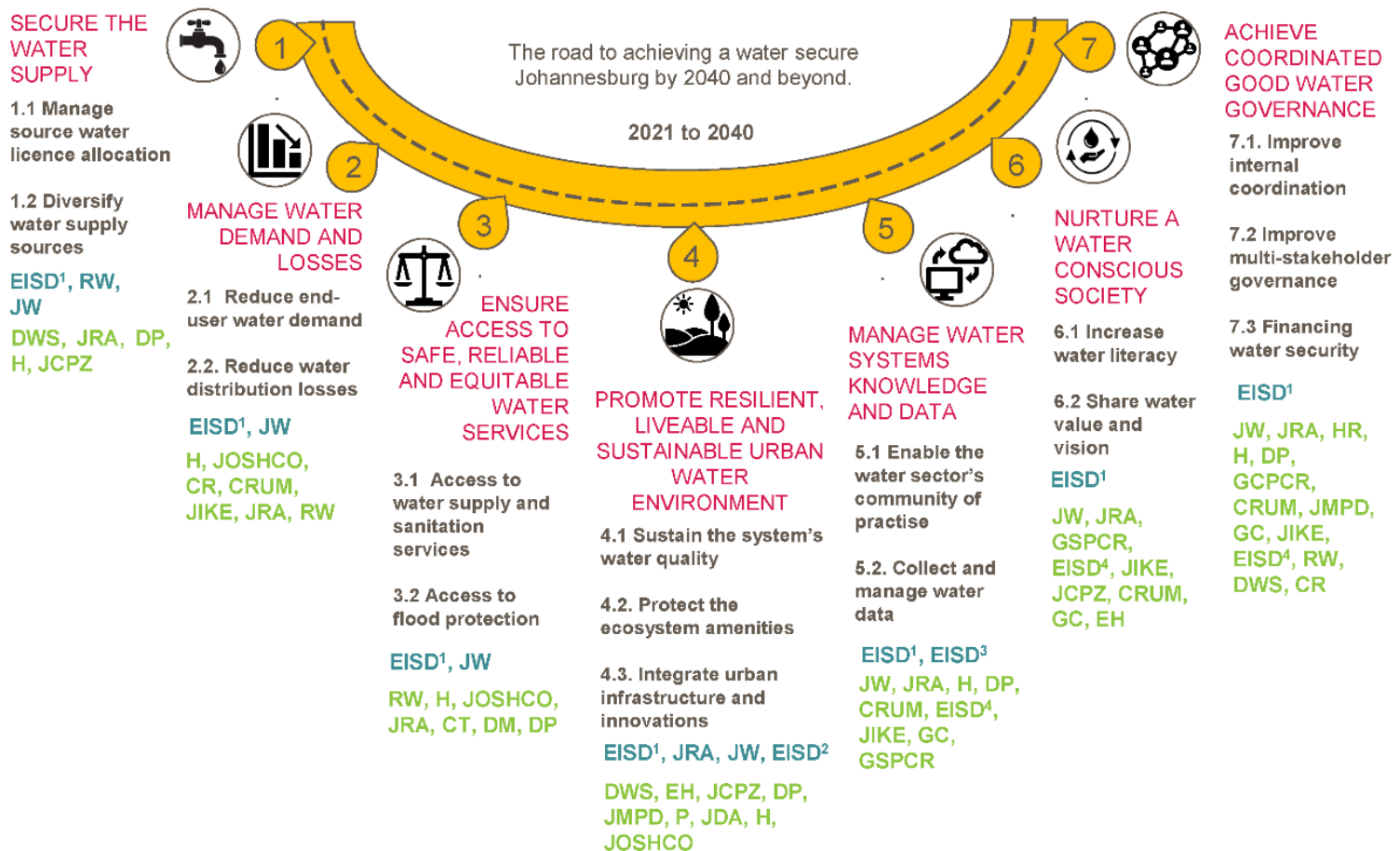


Figure 9: Summary of Johannesburg's Water Security Strategy

Organisations included in the diagram: EISD¹ (Water and Biodiversity), Rand Water (RW), Johannesburg Water (JW), Department of Water and Sanitation (DWS), Johannesburg Roads Agency (JRA), Development Planning (DP), Housing (H), Johannesburg City Parks and Zoo (JCPZ), Johannesburg Social Housing Company (JOSHCO), CoJ Revenue (CR), Citizen Relationship and Urban Management (CRUM), Joburg Innovation and Knowledge Exchange (JIKE), CoJ Transport (CT), Disaster Management (DM), Environmental Health (EH), Johannesburg Metropolitan Police Department (JMPD), Pikitup (P), EISD² (Waste Management), Johannesburg Development Agency (JDA), EISD³ (Climate Change), EISD⁴ (Awareness and Stakeholder Management), Group Communications (GC), Group Strategy Policy Coordination & Relations Department (GSPCR), Human Resources (HR)

6 Glossary

Climate Change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer (10), see CoJ's Climate Action Plan.

Institutional Users are tertiary educational institutions, public schools, public hospitals, orphanages, or similar, sport clubs or premises used for public worship, including halls or other buildings used for religious purposes as define by (51)

Multi-level Governance describes the sharing of power between national central government and other levels of government (hence multi-level) and non-governmental actors (hence governance rather than government). (52)

Mural is an online digital workspace for collaborative work. It is like a large online white board where different kinds of information can be inserted to create a visual board of inform

Sustainable Development Goals are 17 global goals which set the blueprint to achieve a better and more sustainable future for all.

Water Crisis is defined as 'A significant decline in the available quality and quantity of fresh water, resulting in harmful effects on human health and/or economic activity' (1).

Water Governance refers to the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of the society.(53)

Water Security is the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability. (3)

7 Abbreviations

CoJ	The City of Johannesburg Metropolitan Municipality
CRUM	Citizen Relationship and Urban Management
DWS	Department of Water and Sanitation
EISD	CoJ: Environment and Infrastructure Services Department
GDARD	Gauteng Department of Agriculture and Rural Development
GDS 2040	Joburg Growth and Development Strategy 2040
GWSP	Gauteng City-Region Water Security Plan
GSPCR	CoJ: Group Strategy Policy Coordination and Relations
IVRS	Integrated Vaal River System
JCPZ	Johannesburg City Parks and Zoo
JDA	Johannesburg Development Agency
JIKE	Joburg Innovation and Knowledge Exchange
JMPD	Johannesburg Metropolitan Police Department
JRA	Johannesburg Roads Agency
JW	Johannesburg Water
LHWP	Lesotho Highlands Water Project
NPC	National Planning Commission
NWSF	National Water Security Framework
NW&SMP	National Water and Sanitation Master Plan
RW	Rand Water
SANS	South African National Standard
UNGA	United Nations General Assembly
WCWDM	Water Conservation and Water Demand Management
WSC	Water Sensitive City
WSUD	Water Sensitive Urban Design
WEF	World Economic Forum
WRC	Water Research Commission
WWTW	Wastewater Treatment Works

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